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Colorado Department
of Public Health
and Environment

TO: ALL PARTIES INTERESTED IN ROCKY FLATS

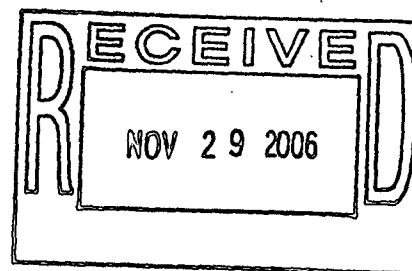
FROM: Nancy Chick, Air Pollution Control Division

Subject: 2001 Air Monitoring Report for Perimeter Stations

Date: May 8, 2003

Enclosed is the final report on the 2001 results for the air monitoring network, stations X-1 through X-5, that borders Rocky Flats. Please note that this portion of the Rocky Flats monitoring project ended operations in July 2001.

If you have questions, please contact me at 303-692-3226 or via email at nancy.chick@state.co.us.



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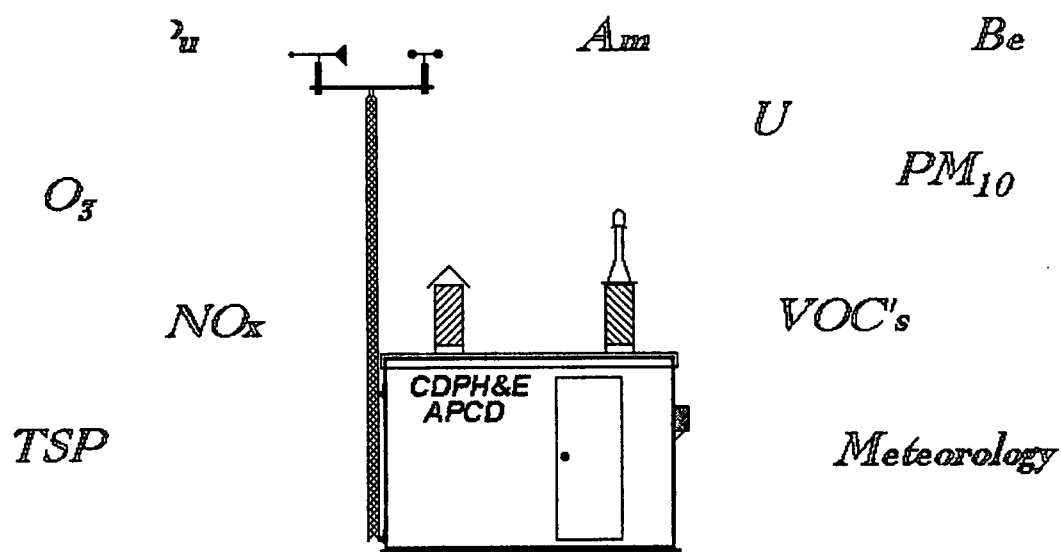
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AIR MONITORING DATA REPORT
ON THE
ROCKY FLATS
MONITORING NETWORK

~~~~ 2001 ~~~~



COLORADO DEPARTMENT OF PUBLIC  
HEALTH & ENVIRONMENT

AIR POLLUTION CONTROL DIVISION

# AIR MONITORING DATA REPORT

ON THE

ROCKY FLATS

MONITORING NETWORK

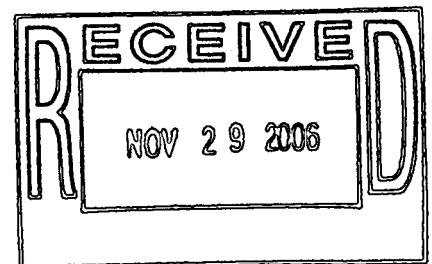
-- 2001 --



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## ACRONYMS

|                    |                                                           |
|--------------------|-----------------------------------------------------------|
| ACGIH              | American Conference of Governmental Industrial Hygienists |
| AIP                | Agreement In Principle                                    |
| Am                 | Americium                                                 |
| APCD               | Air Pollution Control Division                            |
| AQCC               | Air Quality Control Commission                            |
| ASTM               | American Society for Testing Materials                    |
| Be                 | Beryllium                                                 |
| CDPHE              | Colorado Department of Public Health & Environment        |
| CO                 | Carbon monoxide                                           |
| D&D                | Decontamination and decommissioning                       |
| DOE                | United States Department of Energy                        |
| EPA                | United States Environmental Protection Agency             |
| GC/MS              | Gas chromatograph/mass spectrophotometer                  |
| ICAP               | Inductively coupled argon plasma                          |
| LARS               | Laboratory and Radiation Services Division                |
| m <sup>3</sup>     | Cubic meter                                               |
| NAAQS              | National Ambient Air Quality Standards                    |
| NCPP               | National Conversion Pilot Project                         |
| NESHAP             | National Emission Standards for Hazardous Air Pollutants  |
| NIOSH              | National Institute for Occupational Safety and Health     |
| NO                 | Nitric oxide                                              |
| NO <sub>2</sub>    | Nitrogen dioxide                                          |
| NO <sub>x</sub>    | Oxides of nitrogen                                        |
| O <sub>3</sub>     | Ozone                                                     |
| OSHA               | Occupational Safety and Health Administration             |
| Pb                 | Lead                                                      |
| pCi/m <sup>3</sup> | Picocuries per cubic meter                                |
| PM <sub>10</sub>   | Particulate matter 10 microns and smaller in diameter     |
| ppb                | Parts per billion                                         |
| ppm                | Parts per million                                         |
| Pu                 | Plutonium                                                 |
| RFETS              | Rocky Flats Environmental Technology Site                 |
| SO <sub>2</sub>    | Sulfur dioxide                                            |
| TRAC               | Terrain Responsive Atmospheric Code                       |
| TLV                | Threshold limit value                                     |
| TSP                | Total Suspended Particulates                              |
| U                  | Uranium                                                   |
| µg                 | Microgram                                                 |
| µg/m <sup>3</sup>  | Micrograms per cubic meter                                |
| VOC                | Volatile organic compound                                 |

## **1.0 INTRODUCTION**

### **1.1 Purpose of the Report**

This report is being written to provide interested parties the data obtained from ambient air monitoring around the Rocky Flats Environmental Technology Site that is conducted by the Colorado Department of Public Health and Environment, Air Pollution Control Division. This report includes information on monitoring sites, equipment, sampling methods, analytical methods, site locations, monitoring data, comparisons with data from other monitoring sites in the Denver metropolitan area and compliance status as determined by the monitoring data.

### **1.2 Purpose of Monitoring**

The Colorado Department of Public Health and Environment, Air Pollution Control Division has established a monitoring network around the Rocky Flats Environmental Technology Site under the Agreement In Principle, discussed further in section 1.3 below. The network provides data to determine compliance with environmental standards, impact on ambient air quality and risks to the general public.

### **1.3 History**

The Agreement In Principle between the State of Colorado and the United States Department of Energy was signed June 28, 1989. The agreement was designed to assure the citizens of Colorado that health, safety and environment are being protected through increased oversight of the Rocky Flats Environmental Technology Site activities by the State of Colorado. One of the major activities included in the agreement is monitoring to be conducted by the State of Colorado, specifically the Colorado Department of Public Health and Environment, and by the Department Of Energy. In accord with the Agreement In Principle, the Air Pollution Control Division committed to and established the ambient air monitoring network around the Rocky Flats Plant.

As part of the review of the existing monitoring of the Rocky Flats Environmental Technology Site, the Governor's Rocky Flats Scientific Panel on Monitoring Systems (Panel) was established. The Panel reviewed and evaluated the existing monitoring being conducted by the Colorado Department of Public Health and Environment and the Department Of Energy at and near the Rocky Flats facility. Several recommendations for additional monitoring and changes to the existing program for both the Colorado Department of Public Health and Environment and the Department of Energy were made.

The Air Pollution Control Division, working with the Department Of Energy and its contractors, compiled a comprehensive emissions inventory of the plant. Using the emissions inventory, past experience, and the Panel recommendations, specific pollutants which were most likely to have an ambient air and public health impact were identified. After identification of the pollutants using emission type, United States Environmental Protection Agency criteria, past experience and Panel recommendations, specific monitoring equipment and methods were selected. Data from the comprehensive emissions inventory were used in a computer model to estimate the major points of potential air pollution impacts for areas located off the Rocky Flats property.

Five locations were selected for monitoring sites using model results and Environmental Protection Agency siting criteria, thus placing a ring around the Rocky Flats Environmental Technology Site.

Monitoring commenced in July of 1992 at three sites. The first sites were located on the north and east side of the plant since these areas were determined by modeling to have the highest potential impact from air pollutants released by the Rocky Flats facility. Two additional sites, one on the south and one on the west, began monitoring in January of 1995.

#### **1.4 Air Quality Standards**

The Environmental Protection Agency has established National Ambient Air Quality Standards for seven pollutants, known as "criteria" pollutants. They are carbon monoxide (CO), ozone (O<sub>3</sub>), nitrogen dioxide (NO<sub>2</sub>), sulfur dioxide (SO<sub>2</sub>), particulate matter 10 microns in aerodynamic diameter and smaller (PM<sub>10</sub>), particulate matter 2.5 microns in aerodynamic diameter and smaller (PM<sub>2.5</sub>), and lead (Pb). The particulate standard was changed during 1987 from measurement of total suspended particulates (TSP) to PM<sub>10</sub>. In 1997, the Environmental Protection Agency established new standards for ozone and revised the form of the standard for PM<sub>10</sub>. Additionally, a new standard for fine particulate matter was established as PM<sub>2.5</sub> (particulate matter 2.5 microns in aerodynamic diameter and smaller) in 1997.

The current National Ambient Air Quality Standards are presented in Table 1 on page A-1 of Appendix A. Pollutant concentrations higher than the standards are considered unhealthy. Concentrations below the standards are considered acceptable. Primary standards are intended to protect public health while secondary standards are intended to protect public welfare (e.g., nuisance, property damage, etc.). Since the standards take into account both the concentration level of the pollutant and the duration of exposure, they are expressed in terms of a concentration level averaged for a certain period of time.

Determination of a violation of a standard is dependent on the pollutant and standard in question, e.g., ozone and PM<sub>10</sub> violations are calculated as an average over three years of data. A violation occurs when the standard is exceeded more than an average of once per year over a three year period for O<sub>3</sub> and PM<sub>10</sub>. The standards for the criteria pollutants are listed in Table 1 of Appendix A. The standards included in the table are annual for NO<sub>2</sub>, SO<sub>2</sub>, PM<sub>10</sub> and PM<sub>2.5</sub>, quarterly for Pb, 24 hour for SO<sub>2</sub>, PM<sub>10</sub> and PM<sub>2.5</sub>, eight-hourly for CO and O<sub>3</sub>, and hourly for CO, and SO<sub>2</sub>. The old TSP standards are included for reference.

Most pollutants do not currently have National Ambient Air Quality Standards. Some pollutants other than those mentioned above may have adverse effects or play a role in a problem for which standards are being contemplated. Therefore, monitoring of some non-criteria pollutants unique to the Rocky Flats site is conducted by the Air Pollution Control Division. These non-criteria pollutant levels may be assessed through comparison to research data on toxicity and workplace standards (such as those of the National Institute Of Safety and Health, the Occupational Safety and Health Act, and the American Conference of Governmental Industrial Hygienists). Additionally, the State of Colorado has an ambient air quality standard with a monthly average concentration of less than 1.5 µg/m<sup>3</sup> for lead.



## **2.0      AMBIENT AIR MONITORING NETWORK AROUND ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE**

The air pathway is one of the major concerns in protecting public health and welfare in the vicinity of the Rocky Flats facility. To assure that the emissions impacting on the public are within regulatory and known health limits, the Air Pollution Control Division has established an ambient air monitoring network around the outer perimeter of the plant boundaries. This ambient air monitoring network began operating in July of 1992 and was expanded in January 1995. The gaseous and particulate portions of the air network were shut down in June of 2001. The collection of nine years of data has shown that pollutant levels are low at the boundary of the facility. Therefore, the Colorado Department of Public Health and Environment has decided that it is more important to monitor inside the facility. The monitors operating within the fence line will continue. The five stations discussed in this report will continue monitoring as meteorological stations, because wind speed and direction data are needed for emergency response planning.

### **2.1      Pollutants Monitored**

Some of the pollutants monitored are not normally part of the general list of analytes for the Air Pollution Control Division. All the volatile organic compounds (VOCs) checked are not normally monitored in the state, although some special air toxics studies have assessed concentrations at a few locations. The metals and radionuclides, which are specific to the Rocky Flats Environmental Technology Site, are not measured elsewhere. The Air Pollution Control Division used several sources to establish the list of pollutants to be monitored around the Rocky Flats facility. Those sources included the comprehensive emissions inventory conducted by the Air Division and the Department Of Energy based on chemical/material usage, Colorado Air Quality Control Commission Regulations, Air Division inspection reports, Agreement In Principle requirements, Environmental Protection Agency criteria pollutants and National Emission Standards for Hazardous Air Pollutants lists, and recommendations from the Governor's Rocky Flats Scientific Panel on Monitoring Systems. As a result of those reviews, the Air Pollution Control Division determined that the pollutants to be monitored include both particulates and specific gaseous compounds.

#### **2.1.1    Particulates**

Two types of particulates are collected, total suspended particulates (TSP) and PM<sub>10</sub> (particulate matter 10  $\mu$ m and smaller). In addition to the gross weight calculated in micrograms per cubic meter ( $\mu$ g/m<sup>3</sup>) the particulates of both types of particulate filters are analyzed for specific metals and radionuclide concentrations. The metals and radionuclides monitored are beryllium (Be), plutonium (Pu), americium (Am) and uranium (U). Specific collection equipment and frequency of sampling are discussed in Section 2.2.

#### **2.1.2    Gaseous**

Gaseous sampling is conducted for oxides of nitrogen (NO<sub>x</sub>) and thirty-three VOCs. The two NO<sub>x</sub> compounds measured in parts per million (ppm) are nitric oxide (NO) and nitrogen dioxide (NO<sub>2</sub>).

The VOCs being analyzed include:

|                                       |                                      |
|---------------------------------------|--------------------------------------|
| 1,1,1,2-tetrafluoroethane (H-134a)    | chlorodifluoromethane (Freon-22)     |
| dichlorodifluoromethane (Freon-12)    | chloromethane                        |
| dichlorotetrafluoroethane (Freon-114) | vinyl chloride                       |
| 1,3-butadiene                         | ethyl chloride                       |
| dichlorotrifluoroethane (Freon-123)   | trichlorofluoromethane (Freon-11)    |
| 1,1-dichloroethene                    | dichloromethane (methylene chloride) |
| trichlorotrifluoroethane (Freon-113)  | methyl tertiary butyl ether          |
| 1,1-dichloroethane                    | chloroform                           |
| 1,2-dichloroethane                    | 1,1,1-trichloroethane                |
| carbon tetrachloride                  | benzene                              |
| trichloroethylene                     | 1,1,2-trichloroethane                |
| toluene                               | tetrachloroethylene                  |
| chlorobenzene                         | ethyl benzene                        |
| m- + p-xylene                         | styrene                              |
| 1,1,2,2-tetrachloroethane             | o-xylene                             |
| methyl ethyl ketone                   | methyl butyl ketone                  |
| methyl isobutyl ketone                |                                      |

Three VOCs, carbon tetrachloride, 1,1,1-trichloroethane and methylene chloride, are target compounds due to historically high usage levels at the Rocky Flats facility. The other VOCs on the above list were used occasionally or historically, or may be emitted during remediation activities. All VOC results are reported in parts per billion (ppb).

While not an originally selected pollutant, ozone (O<sub>3</sub>) is also being monitored at one site as part of the Air Pollution Control Division's Denver Metropolitan Area Network. It is reported in parts per million. As ozone levels are high along the foothills of Denver, the ozone station will continue operation for the foreseeable future.

### **2.1.3 Meteorological Monitoring**

Meteorological monitoring is conducted at each site for wind speed and direction (both vector and scalar) and temperature. Separate vane and cups are used for the wind direction and speed with a naturally aspirated vane shield used around the temperature sensor. The vane and cups are at the top of a ten-meter high tower with the temperature probe located at 6 meters above the ground. Wind speed results are reported in miles per hour, wind direction in degrees and temperature in degrees Fahrenheit.

## **2.2 Monitoring Methods**

Upon selection of the pollutants to be monitored, the Air Pollution Control Division reviewed previously used and current EPA-recommended sampling techniques for each chemical compound. Based on the review and recommendations of the Governor's Rocky Flats Panel on Monitoring Systems the specific equipment was selected. The monitoring equipment consists of particulate and gaseous monitors. All sampling and analytical methods are approved by the EPA as reference/equivalent methods, or follow suggested EPA guidelines.

### **2.2.1 Particulate Matter**

There are two particulate monitoring systems being operated by the Air Pollution Control Division in the vicinity of the Rocky Flats facility: TSP and PM<sub>10</sub>. The Colorado Department Of Public Health and Environment's Laboratory and Radiation Services Division conducts all analyses of particulate matter.

#### **2.2.1.1 TSP**

TSP is collected on glass fiber filter pads. The samplers are made by General Metal Works and use a vacuum cleaner motor to draw air through the filter. Each unit operates for twenty-four hours every sixth day. The units are identical to those used by the Air Pollution Control Division throughout the state.

#### **2.2.1.2 PM<sub>10</sub>**

PM<sub>10</sub> samplers collect particulate matter 10 microns and smaller in aerodynamic diameter on quartz fiber filters. The samplers are made by Wedding & Associates and use a vacuum cleaner motor to draw air through the filter. Each unit operates for twenty-four hours every sixth day. The units are identical to those used by the Air Pollution Control Division throughout the state and meet the Environmental Protection Agency requirements as a reference method under EPA RFPS-1087-062.

#### **2.2.1.3 Filter Analysis**

The TSP and PM<sub>10</sub> filters are weighed both before and after sampling to determine the particulate loading. The weight of particulate loading in micrograms ( $\mu\text{g}$ ) divided by the cubic meters ( $\text{m}^3$ ) of air drawn through the filter gives the ambient air concentration in  $\mu\text{g}/\text{m}^3$ . The metal analyses performed on the filters were done on monthly composites of the filters for each particulate sampler from July 1992 through September 1993. All composites beginning with October 1993 are quarterly composites due to low levels of pollutants found. There is a composite performed for each separate sampler being operated. The composite samples are analyzed for beryllium (Be) using inductively coupled argon plasma (ICAP) and results are provided in micrograms of pollutant per cubic meter of air ( $\mu\text{g}/\text{m}^3$ ). Uranium (U), Plutonium (Pu) and Americium (Am) analyses are by alpha spectrometry and provide results in picocuries of radiation per cubic meter ( $\text{pCi}/\text{m}^3$ ).

### **2.2.2 Gaseous**

There are three gaseous monitoring systems being operated by the Air Pollution Control Division in the vicinity of the Rocky Flats Plant. One is for oxides of nitrogen (NO<sub>x</sub>), the second is for volatile organic compounds (VOCs) and the third is for ozone (O<sub>3</sub>).

#### **2.2.2.1 Oxides of Nitrogen (NO<sub>x</sub>)**

Two compounds, NO and NO<sub>2</sub>, are analyzed on a continuous basis. The analyzers used at the two sites are an API 200 at X-5 and an API 200A at X-3. Both of these units operate using the chemiluminescent principle. The units meet the EPA requirements as reference methods under RFNA-0691-082 for the API 200 and RFNA-1194-099 for the API 200A. The data from each day of sampling are transmitted to the Air Pollution Control Division computer for data storage once each day via cellular phone. Automatic zero and span checks are run each day as part of the quality assurance. Calibrations are performed every quarter and independent audits are performed at least once per year.

Monitoring for oxides of nitrogen at X-1 and X-4 was discontinued in January 1999 due to low levels being recorded. X-3 and X-5 were discontinued in June 2001.

#### **2.2.2.2 Volatile Organic Compounds (VOC)**

Gaseous sampling for VOCs is conducted using multi-bed solid sorbent tubes filled with Carbopack-B, Carbopack-C and molecular sieve. The tubes are thermally desorbed followed by gas chromatography/ mass spectrometry (GC/MS) analysis, according to EPA Method TO-17 guidelines. Samples are taken for 24 hours every sixth day by drawing ambient air through the sorbent tubes, which adsorb VOCs. One tube is used during each sampling period. Backup tubes to check for sample break-through of the primary tube were discontinued in 1998. A second tube at one site is not exposed to any air flow and is used as a field blank for quality assurance. Additionally, one tube is also transported, but never opened, as a trip blank to check for potential storage contamination. Each tube is analyzed for VOCs in the Colorado Department of Public Health and Environment Laboratory following EPA Method TO-17 guidelines. (See compound list in Section 2.1.2). Flow checks are performed monthly. Calibrations are performed twice per year and an independent audit is performed at least once per year. VOCs were discontinued in July 2001, as levels were low and appeared to be mainly motor vehicle emissions, rather than Rocky Flats plant emissions.

#### **2.2.2.3 Ozone (O<sub>3</sub>)**

O<sub>3</sub> is analyzed on a continuous basis. The analyzer is a Monitor Labs 8810, which uses ultraviolet absorption. The EPA equivalency method is EQOA-0881-053. The data from each day of sampling are transmitted to the Air Pollution Control Division computer for data storage once each day via cellular phone. Automatic zero and span checks are run each day as part of the quality assurance. Calibrations are performed every quarter and independent audits are performed at least once per year.

### **2.2.3 Meteorological**

The meteorological equipment operates on a continuous basis. The equipment being used is manufactured by Met-One Instruments. The meteorological equipment provides wind speed, wind direction and temperature data. The equipment is mounted on a ten-meter tower with the information being transmitted to the Air Pollution Control Division computer once each day via cellular phone. Calibrations are performed twice per year and an independent audit is performed at least once per year.

The meteorological data are also shared with the DOE via a special data link to feed the data into the Rocky Flats CAPARS (TRAC) model, which is used for emergency situations. The meteorological data collection will continue until all plant clean-up activities are completed.

### **2.3 Monitoring Locations**

Three Air Pollution Control Division monitoring sites located just off the north and east property boundaries of the Rocky Flats facility commenced operation in June 1992. Two additional sites, to the south and west, were activated in January 1995. The sites were selected using modeling techniques to determine the major impact points for emissions from the plant to the general public. An additional goal was to determine the location of a nearby background/ upwind site not normally influenced by the plant. The five sites form a ring around the Rocky Flats Environmental Technology Site, providing complete air monitoring coverage. The sites are designated X-1 through X-5. Figure 1 on page B-1 of Appendix B shows the locations of the monitoring sites.

#### **2.3.1 X-1**

X-1 is located to the north-north east of the plant on the south side of Colorado Highway 128, approximately 1 1/4 miles to the west of Indiana Street (16600 W. Hwy. 128). Monitoring at this site includes TSP, PM<sub>10</sub>, Be, U, VOC, meteorology and O<sub>3</sub>. NO<sub>x</sub> monitoring at this site was discontinued in January 1999, and all other parameters except meteorology and O<sub>3</sub> were discontinued as of July 2001.

#### **2.3.2 X-2**

X-2 is located to the east-northeast of the plant on the west side of Indiana Street approximately 1 mile north of the East Access Gate in the Walnut Creek drainage (11501 Indiana St.). Monitoring at this site includes TSP, PM<sub>10</sub>, Be, U, VOC and meteorology. As of July 2001, all parameters except meteorology were discontinued.

#### **2.3.3 X-3**

X-3 is located to the east-southeast of the plant on the west side of Indiana Street approximately 1 mile south of the East Access Gate in the Woman Creek drainage (9901 Indiana St.). Monitoring at this site includes TSP, PM<sub>10</sub>, Be, U, VOC, NO<sub>x</sub> and meteorology. As of July 2001, all parameters except meteorology were discontinued.

#### **2.3.4    X-4**

X-4 is located on the south side of Colorado Highway 72 approximately 2 miles east of Colorado Highway 93 (18000 West Highway 72). Monitoring at this site includes TSP, PM<sub>10</sub>, Be, U, VOC, and meteorology. NO<sub>x</sub> monitoring at this site was discontinued in January 1999. As of July 2001, all parameters except meteorology were discontinued.

#### **2.3.5    X-5**

X-5 is located on the east side of Colorado Highway 93 approximately 1 mile north of the West Access Gate (11190 Highway 93). Monitoring at this site includes TSP, PM<sub>10</sub>, Be, U, Am, Pu, VOC, NO<sub>x</sub> and meteorology. This site was designed as an upwind/background site. However, it sometimes records the highest TSP and PM<sub>10</sub> results, due to the presence of a nearby sawmill and gravel aggregate operations. As of July 2001, all parameters except meteorology were discontinued.

### **3.0       DATA RESULTS**

The following subsections discuss the data obtained from the Air Pollution Control Division ambient air monitoring network around the Rocky Flats Environmental Technology Site by pollutant. Tables and graphs depicting the ambient air monitoring data are in Appendices C through I. Subsection 3.11 contains a narrative on comparisons of the data found around the Rocky Flats Site with other Air Pollution Control Division monitoring sites in the Denver metropolitan area. These data and comparisons are contained in Appendix J.

#### **3.1       TSP**

Particulates may be released into the atmosphere from a number of sources at Rocky Flats. The main sources are any machining, grinding, earth moving, combustion, foundry or forming/molding sources. Additionally, the wind or other mechanical actions may cause particulates to be re-entrained in the air. TSP is generally defined as particles less than 100 microns in aerodynamic diameter, however, the major catch on the TSP filters is 40 microns in diameter or less. The levels of TSP have been very low with the exception of the summer of 1995. During this period, particularly in August 1995, construction of the Woman Creek Diversion Reservoir was taking place immediately across the street from the X-3 site. As a result of earth moving operations, TSP levels at X-3 were very high with a maximum of 501  $\mu\text{g}/\text{m}^3$ . This level significantly exceeded the former NAAQS for TSP of 260  $\mu\text{g}/\text{m}^3$  for a 24-hour sample. After completion of the reservoir, TSP levels decreased.

The average and maximum data for TSP results by month for the first half of 2001, both in table and graph form, are in Appendix C. For 2001, the maximum 24-hour value recorded was 129  $\mu\text{g}/\text{m}^3$  at X-4 and the maximum annual average was 63  $\mu\text{g}/\text{m}^3$  at X-5. Both of these values are well below the former NAAQS. Data in 2001 were similar to levels seen in 2000. The annual means are slightly higher because 2001 only includes a half-year of data. X-5 was frequently the highest recording site for each month, probably due to its proximity to Highway 93, a nearby sawmill and nearby quarries. Therefore, contrary to network planning expectation, it is not a

“background” site. Appendix C also includes a table and graph of historical quarterly average data and shows that the data for 2001 were typical.

Note that there are two TSP samplers at X-1, which are run simultaneously to provide a quality control check on the monitors.

### 3.2 PM<sub>10</sub>

Particulates may be released into the atmosphere from a number of sources at the Rocky Flats facility. The main sources are any machining, grinding, earth moving, combustion, foundry or forming/molding sources. Additionally, the wind or other mechanical actions may cause particulates to be re-entrained in the air. PM<sub>10</sub> particles are 10 microns or less in aerodynamic diameter. These particles are easily inhaled and can cause respiratory problems. With the exception of the summer of 1995, the PM<sub>10</sub> levels detected have been well below those that would cause any health concern. During that period, particularly in August 1995, construction of the Woman Creek Diversion Reservoir was taking place immediately across the street from the X-3 site. As a result of earth moving operations, PM<sub>10</sub> levels at X-3 were elevated with a maximum of 87  $\mu\text{g}/\text{m}^3$ , which is still well below the NAAQS for PM<sub>10</sub> of 150  $\mu\text{g}/\text{m}^3$  for a 24-hour sample. After completion of the reservoir, PM<sub>10</sub> levels decreased.

The average and maximum data for PM<sub>10</sub> results by month for 2001, both in table and graphic form, are in Appendix D. For 2001, the maximum 24-hour value recorded was 36  $\mu\text{g}/\text{m}^3$  at X-2-C, and the maximum annual average was 17  $\mu\text{g}/\text{m}^3$  at X-2-C and X-5. Both of these values are well below the National Ambient Air Quality Standards. In past years, PM<sub>10</sub> data showed a typical trend of being higher in March, most likely due to blowing dust in gusty wind conditions. In the year 2001, highest values occurred in June. This is also due to blowing dust, which occurs more frequently in the dry summer period. Appendix D also includes a table and graph of historical quarterly average data and shows that the data for 2001 were similar to levels observed in previous years.

Note that there are two PM<sub>10</sub> samplers at X-2, which provides a quality control check on the monitors.

### 3.3 Oxides of Nitrogen (NO<sub>x</sub>)

Oxides of nitrogen (NO<sub>x</sub>) are typically a by-product of combustion, which is the major source of NO<sub>x</sub> at the Rocky Flats Environmental Technology Site. There have historically been large amounts of nitric acid use at the plant. In the presence of sunlight nitric acid (HNO<sub>3</sub>) can degrade to NO<sub>2</sub> and OH. Nitric acid use decreased greatly after the shutdown of plant production in 1990. Therefore, the levels of NO<sub>x</sub> detected in ambient air in recent years have been very low. It is likely that automotive traffic on the roads surrounding the Rocky Flats site is the major emissions source of oxides of nitrogen.

The data for average NO<sub>x</sub> results, as nitric oxide (NO) and nitrogen dioxide (NO<sub>2</sub>) by month for the calendar year 2001, both in table and graph form, are in Appendix E. The Appendix also includes a table and graph of quarterly averages for 1999 through 2001 and monthly 1-hour maximum data for 2001. For NO, a maximum 1-hour value of 0.115 ppm was recorded in 2001

at X-3 and the maximum annual average of 0.008 ppm occurred at X-5. For NO<sub>2</sub>, a maximum 1-hour value of 0.066 ppm was recorded at X-3 and the maximum annual average 0.010 ppm also occurred at X-3. NO<sub>x</sub> levels are slightly higher in the winter than in the spring, probably due to seasonal temperature inversions that trap air close to the ground, permitting buildup of air pollutant concentrations. The quarterly averages show that levels in 2001 were typical compared to previous years.

### **3.4 Volatile Organic Compounds (VOC)**

VOCs released from the Rocky Flats Environmental Technology Site are mainly solvents. The three major VOCs used at the plant during production were carbon tetrachloride, 1,1,1-trichloroethane and methylene chloride. In 2001, thirty VOCs were analyzed following EPA Method TO-17 guidelines. Of these, 22 were detected at some time in 2001. Freons, probably from refrigeration units (industrial and automotive) as well as automotive-related combustion by-products/compounds, such as benzene, toluene, and xylenes, were consistently detected. Additionally, chloromethane, methylene chloride (dichloromethane), 1,1,1-trichloroethane, vinylidene chloride, and carbon tetrachloride were consistently detected. Trichloroethene, and tetrachloroethene were seen during certain seasons. All levels were well below threshold limit values.

The data for monthly average VOCs for 2001 are presented in a table in Appendix F. Graphs are also presented for compounds that were detected during the year.

### **3.5 Ozone (O<sub>3</sub>)**

Ozone is a secondary pollutant formed by the reaction of nitrogen oxides and hydrocarbons in the presence of sunlight. Thus, high ozone concentrations generally occur during the summer months and in the early afternoon during the peak sunlight hours. Since high levels of nitrogen oxides and hydrocarbons can break down ozone, high ozone concentrations most often occur away from urban centers. The area around the Rocky Flats Environmental Technology Site is outside of the Denver core area and meteorologically is often downwind of Denver during late mornings and early afternoons. The entire western foothills area, from Chatfield Reservoir in the south to Rocky Mountain National Park in the north, is often an area of high ozone concentrations. Maximum concentrations in 2001 were consistent with concentrations recorded in previous years and are below the old 1-hour NAAQS of 0.12 ppm with a maximum 1-hour value of 0.112 ppm being recorded. Compared to the new 8-hour NAAQS of 0.08 ppm, the maximum concentration recorded in 2001 of 0.087 ppm is just above this standard after rounding. The standard actually looks at the average of the fourth maximum 8-hour value over three years. In 2001, this fourth maximum value was 0.082 ppm.

The average monthly data for O<sub>3</sub> results by month for the calendar year of 2001, both in table and graphic form, are in Appendix G and show a typical trend of being higher in the summer. The Appendix also includes a table and graph of quarterly averages for 1999 through 2001 and monthly 1-hour and 8-hour maximum data. Quarterly average values, compared to previous years, were typical.



Note that ozone is not a planned monitored pollutant at the Rocky Flats Site. However, as part of a previous special Denver metropolitan area study, O<sub>3</sub> monitoring was initiated at X-1. It will continue in the future.

### **3.6     Beryllium (Be)**

Be is a naturally occurring element in the form of mineral beryl, which is found in the soils around the Rocky Flats Environmental Technology Site at low levels, as well as being a metal formerly used in the processing at the plant. Be is on the National Emission Standards for Hazardous Air Pollutants (NESHAPS) list and is one of the compounds listed in the Colorado Air Quality Control Commission's Regulation No. 8 as a hazardous or toxic substance.

The data for Be results, by quarter, for the calendar year 2001 are in Appendix H. These quarterly results are for composite samples for each sampler. As can be seen, no Be was detected at any of the five sites in 2001 for either TSP or PM<sub>10</sub>, and thus no graphing or averaging was done.

### **3.7     Plutonium (Pu)**

Pu is considered to be a man-made element and does not occur naturally. Therefore, any Pu detected can be related to the Rocky Flats Plant or to worldwide fall-out created by testing of nuclear weapons.

Pu emissions were analyzed, in both TSP and PM<sub>10</sub>, at X-5 only. The Colorado Department of Public Health and Environment Laboratory has continued to monitor for Pu at other locations around the Rocky Flats Site but those data are not part of this Air Pollution Control Division report. The data for Pu results, by quarter, for the calendar year of 2001 are in Appendix H. These quarterly results are for composite samples. As can be seen, no Pu was detected in 2001.

### **3.8     Americium (Am)**

Am is a man-made element and a by-product of Pu which is not naturally occurring. Any Am detected is considered to be connected with the plant or to worldwide fall out created by testing of nuclear weapons.

Am emissions were analyzed, in both TSP and PM<sub>10</sub>, at X-5 only. The Colorado Department of Public Health and Environment Laboratory has continued to monitor for Am at other locations around the plant but those data are not part of this report, which discusses only monitoring at the Rocky Flats perimeter sites X-1 through X-5. The data for Am results, by quarter, for the calendar year of 2001 are in Appendix H. These quarterly results are for composite samples. No Am was detected in the PM<sub>10</sub> or the TSP particulate matter size fractions.

### **3.9     Uranium (U)**

U is a naturally occurring element in the soils around the Rocky Flats Environmental Technology Site. However, the plant is also a source that must be monitored.

The data for U results, by quarter, for the calendar year of 2001 are in Appendix H. These quarterly results are for composite samples for each sampler. Note that for the year 2001, uranium analyses were reported by isotope. Uranium 234 and 238 were present in both TSP and PM<sub>10</sub> size fractions, with the PM<sub>10</sub> levels close to those found in TSP. Uranium 235 was not present in either size fraction.

### **3.10 Meteorology**

Meteorological data are presented in Appendix I and include monthly and quarterly average data for wind speed and temperature as well as monthly 1-hour maximum data. Wind rose plots for wind speed and direction are also presented in Appendix I.

The data show the Rocky Flats area to have very high wind speeds. A 1-hour maximum wind speed of 49 miles per hour was recorded at the X-1 site in 2001 and a maximum annual average of 9.0 miles per hour was also measured at site X-1. Graphs of the quarterly average data show that wind speeds in 2001 were comparable to previous years and show a typical pattern of being higher in the winter. The wind rose diagrams show predominant winds from the west-northwest, especially at night when down slope wind conditions prevail. During the daytime, winds are often from the south-southeast to east, which is more indicative of up slope conditions and convection heating. It can also be seen that the wind directions are less variable at X-2 and X-3 as they are in drainage valleys.

The maximum 1-hour temperature recorded in 2001 was 94 degrees Fahrenheit at X-2. Quarterly average data show that temperatures in 2001 were comparable to previous years.

### **3.11 Comparisons to Other Sites**

The data obtained from the Air Pollution Control Division monitors around the Rocky Flats Site were compared to available data from other monitoring sites around the Denver metropolitan area where some or all of the pollutants were monitored. The comparison stations that were used are the CAMP Station (downtown Denver), Adams City, Birch Street, Arvada, NREL (South Table Mountain), South Boulder Creek, Boulder Chamber and Welby. Table 2 on page A-2 of Appendix A lists the monitoring sites, locations and pollutants sampled. Figure 2 on page B-2 of Appendix B is a map showing the locations of the Rocky Flats and the Denver area sites used for comparisons.

In 2001 the only Air Pollution Control Division monitoring stations to sample for metals/radionuclides were at the Rocky Flats site. The CAMP site sampled for VOCs during the year 2001, and the data are available as a separate report. Therefore, no comparisons were made with other sites for those pollutants. Nor will there be any comparisons made with meteorological data since the purpose of the report is not to assess impacts from point sources of air pollution. Most of the large point sources at the Rocky Flats site are no longer active.

### 3.11.1 Particulate Matter

Appendix J contains tables and graphs for TSP and PM<sub>10</sub> that compare data from the Rocky Flats sites to other sites. In both cases the monitoring results for monthly average particulate concentrations are much lower at the Rocky Flats sites than at the CAMP and Birch Street sites. Monthly average PM<sub>10</sub> concentrations are slightly lower than at the Boulder Chamber site. Similarly, the monthly 24-hour maximum particulate concentrations at the Rocky Flats sites for TSP are much lower than at the CAMP and the Birch Street sites. For 24-hour maximum PM<sub>10</sub> concentrations, the Rocky Flats sites are much lower than at the CAMP or Birch Street sites and slightly lower than the Boulder Chamber site.

### 3.11.2 NO<sub>x</sub>

Appendix J contains tables and graphs comparing NO and NO<sub>2</sub> monthly averages to those found at the CAMP and Welby stations. For both NO and NO<sub>2</sub>, the Rocky Flats Environmental Technology sites are well below the monthly averages noted for the other two stations. Comparing monthly 1-hour maximums at the same locations, the Rocky Flats locations are again well below the other two stations.

### 3.11.3 O<sub>3</sub>

Ozone is not one of the pollutants designated for monitoring in the Rocky Flats network. Although the site emits some volatile organic compounds, current cleanup operations at Rocky Flats are not expected to create large concentrations of ozone. However, as noted previously, the western foothills area of metropolitan Denver is an area of high ozone concentrations. Therefore the Rocky Flats X-1 station is used as part of the Air Pollution Control Division special ozone study network and has provided valuable information. Appendix J presents ozone data from X-1 compared to five other sites. Four of these other sites, Welch, Arvada, NREL, and South Boulder Creek, are along the western foothills corridor where ozone levels are a concern. The fifth location, Welby, is located northeast of the Denver core area, along the down wind Platte River drainage. Monthly average data show that the X-1 site is generally higher than these other sites. The monthly 1-hour maximum data show that the X-1 and NREL values are frequently the highest concentrations observed. These sites are in close proximity to one another. (See Figure 2).

## 4.0 SUMMARY

The monitoring conducted around the boundaries of the Rocky Flats Environmental Technology Site shows values for the pollutants of concern that are below those in other portions of the Denver metropolitan area. In fact the values are typical of the values found on the edges of the Denver area. A major reason for the low values is the change of mission at the plant, which ceased production in October 1990.

This has allowed the Air Pollution Control Division to determine what could be considered to be near background levels in the area. As decontamination and decommissioning (D&D) operations have continued at the Rocky Flats facility, air pollutant levels at the site borders have

continued to remain typical of an edge-of-Denver situation. Thus, the air pollution monitoring network at the Rocky Flats perimeter has not measured significant impacts from site remediation activities. This is probably due to the large buffer zone between the site cleanup activities, and the Rocky Flats site boundaries. With these five Air Pollution Control Division sites in operation, the Rocky Flats plant has been ringed by monitors and the resulting data, up and down wind, provides answers to the level of impact the Rocky Flats facility has on the ambient air and the general public. As levels measured have not changed appreciably over the ten years the network has been operating, much of it was shut down in June 2001. Meteorological monitoring, which is necessary for emergency planning purposes, will continue.

# **APPENDIX A**

## **TABLES**

**Table 1**  
**NATIONAL AMBIENT AIR QUALITY STANDARDS**

| POLLUTANT                                                     | AVERAGING TIME                                                       | STANDARD               |
|---------------------------------------------------------------|----------------------------------------------------------------------|------------------------|
| <b>Carbon Monoxide (CO)</b>                                   |                                                                      |                        |
| Primary Standard                                              | 1 Hour <sup>(a)</sup>                                                | 35 ppm                 |
| Primary Standard                                              | 8 Hour <sup>(a)</sup>                                                | 9 ppm                  |
| <b>Ozone (O<sub>3</sub>)</b>                                  |                                                                      |                        |
| Primary and Secondary Standards (up to 1997)                  | 1 Hour <sup>(b)</sup>                                                | 0.12 ppm               |
| Primary and Secondary Standards (as of July 1997)             | 8 Hour <sup>(c)</sup>                                                | 0.08 ppm               |
| <b>Nitrogen Dioxide (NO<sub>2</sub>)</b>                      |                                                                      |                        |
| Primary and Secondary Standards                               | Annual Arithmetic Mean                                               | 0.053 ppm              |
| <b>Sulfur Dioxide (SO<sub>2</sub>)</b>                        |                                                                      |                        |
| Primary Standard                                              | Annual Arithmetic Mean                                               | 0.030 ppm              |
| Primary Standard                                              | 24 Hour <sup>(a)</sup>                                               | 0.14 ppm               |
| Secondary Standard                                            | 3 Hour <sup>(a)</sup>                                                | 0.5 ppm                |
| <b>Particulates (PM<sub>10</sub>)</b>                         |                                                                      |                        |
| Primary and Secondary Standards                               | Annual Arithmetic Mean <sup>(d)</sup>                                | 50 µg/m <sup>3</sup>   |
| Primary and Secondary Standards                               | 24 Hour <sup>(b)</sup> prior to July 1997, <sup>(e)</sup> as of July | 150 µg/m <sup>3</sup>  |
| <b>Fine Particulates (PM<sub>2.5</sub>) (as of July 1997)</b> |                                                                      |                        |
| Primary and Secondary Standards                               | Annual Arithmetic Mean <sup>(d)</sup>                                | 15.0 µg/m <sup>3</sup> |
| Primary and Secondary Standards                               | 24 Hour <sup>(f)</sup>                                               | 65 µg/m <sup>3</sup>   |
| <b>Lead (Pb)</b>                                              |                                                                      |                        |
| Primary and Secondary Standards                               | Calendar Quarter Average                                             | 1.5 µg/m <sup>3</sup>  |
| <b>Total Suspended Particulates (TSP)</b>                     |                                                                      |                        |
| Primary Standard                                              | Annual Geometric Mean <sup>(g)</sup>                                 | 75 µg/m <sup>3</sup>   |
| Primary Standard                                              | 24 Hour <sup>(g)</sup>                                               | 260 µg/m <sup>3</sup>  |
| Secondary Standard                                            | Annual Geometric Mean <sup>(g)</sup>                                 | 60 µg/m <sup>3</sup>   |
| Secondary Standard                                            | 24 Hour <sup>(g)</sup>                                               | 150 µg/m <sup>3</sup>  |

- (a) Not to be exceeded more than once per year.
- (b) Statistically estimated number of days with concentrations above this level averaged over a three year period, is not to be more than 1 per year.
- (c) The three year average of the fourth maximum value for each year is not to exceed this level.
- (d) The average of three years of annual averages (based on quarterly averages) is not to exceed this level.
- (e) The three year average of the 99<sup>th</sup> percentile for each year is not to exceed this level.
- (f) The three year average of the 98<sup>th</sup> percentile for each year is not to exceed this level.
- (g) The TSP standard was replaced by the PM<sub>10</sub> standard on July 1, 1987. The Colorado state standard for TSP has been abolished. It is listed here for data analysis purposes only.

**Table 2**  
**Stations Used For Comparisons**

| SITE NAME            | LOCATION                                  | TSP | PM <sub>10</sub> | NO <sub>x</sub> | O <sub>3</sub> | MET |
|----------------------|-------------------------------------------|-----|------------------|-----------------|----------------|-----|
| RFETS X-1            | 16600 W. Colorado Hwy. 128                | X   | X                |                 | X              | X   |
| RFETS X-2            | 11501 Indiana Street                      | X   | X                |                 |                | X   |
| RFETS X-3            | 9901 Indiana Street                       | X   | X                | X               |                | X   |
| RFETS X-4            | 18000 W. Colorado Hwy. 72                 | X   | X                |                 |                | X   |
| RFETS X-5            | 11190 Colorado Hwy. 93                    | X   | X                | X               |                | X   |
| DENVER (CAMP)        | 2105 Broadway                             | X   | X                | X               |                | X   |
| WELBY                | 78 <sup>th</sup> Avenue & Steele Street   |     | X                | X               | X              | X   |
| COMMERCE CITY        | 7101 Birch Street                         | X   | X                |                 |                |     |
| ARVADA               | 57 <sup>th</sup> Avenue & Garrison Street |     |                  |                 | X              | X   |
| NREL (S. TABLE MTN.) | 20 <sup>th</sup> Avenue & Quaker Street   |     |                  |                 | X              |     |
| SOUTH BOULDER CREEK  | 1405 1/2 S. Foothills Highway             |     |                  |                 | X              |     |
| BOULDER - CHAMBER    | 2440 Pearl Street                         |     | X                |                 |                |     |

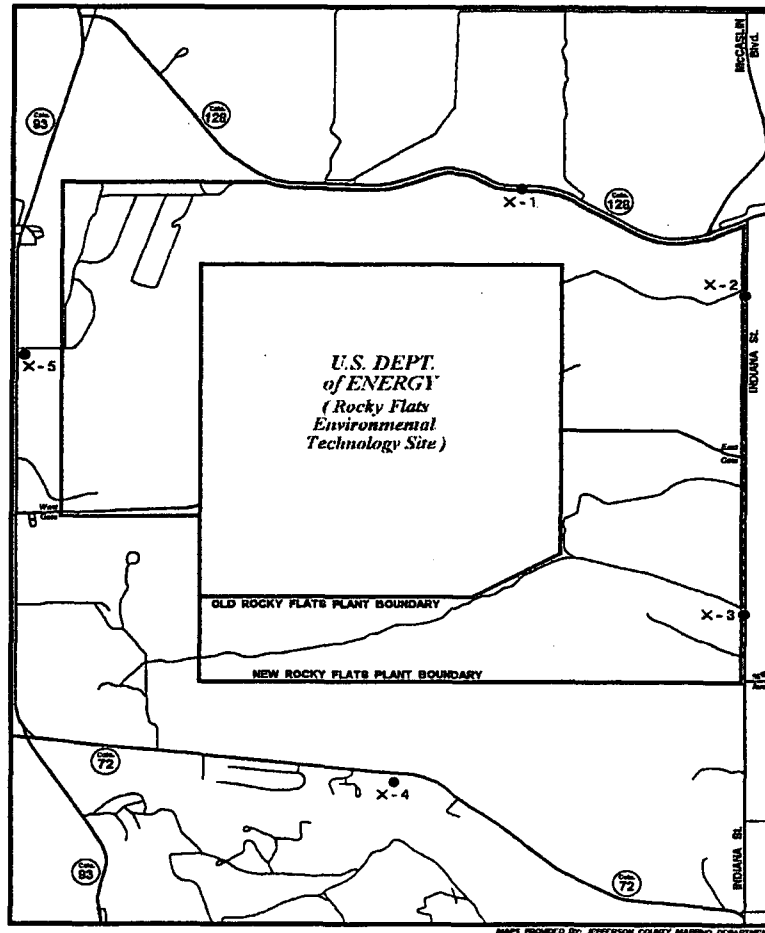
# **APPENDIX B**

## **MAPS**



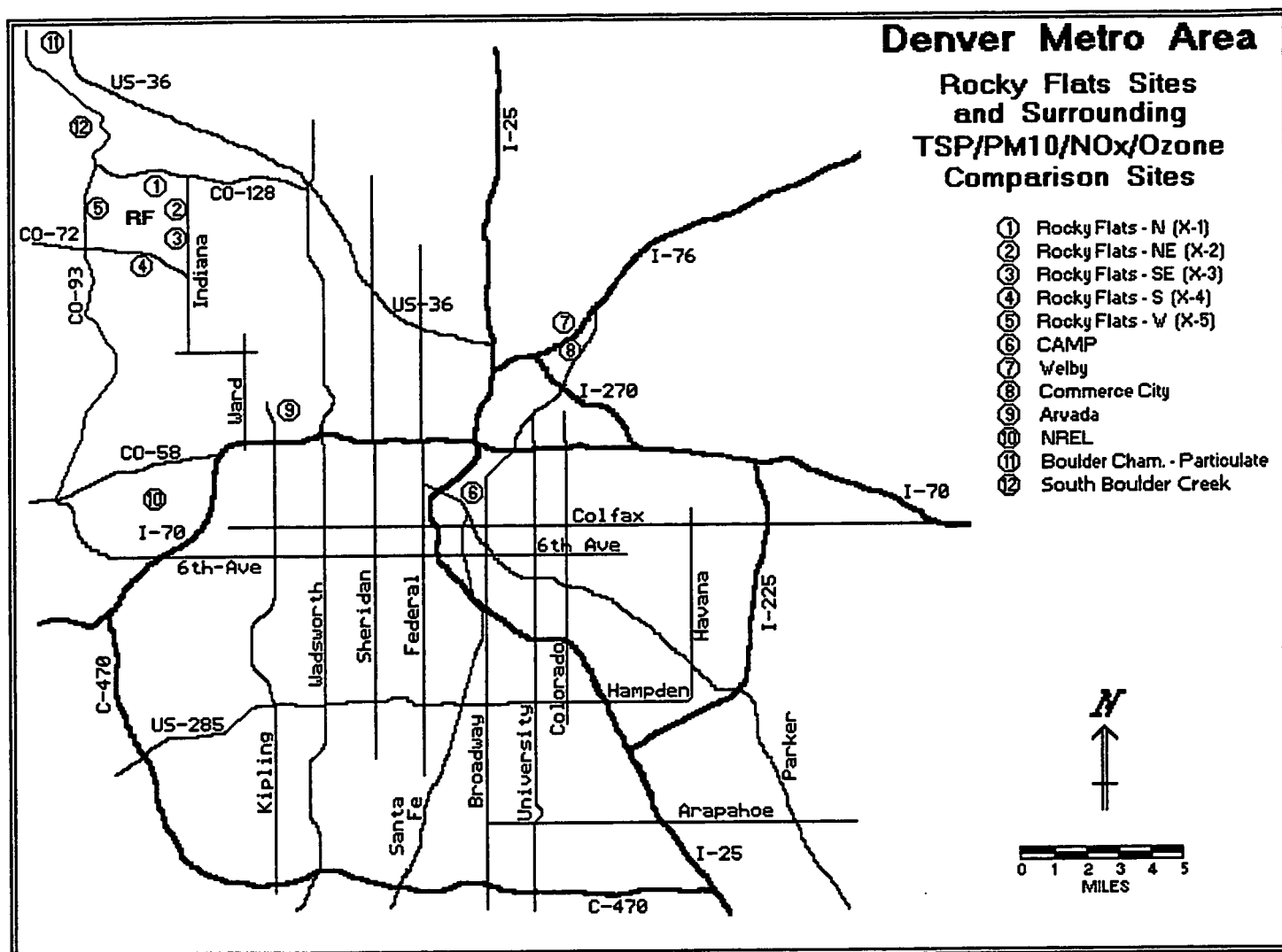
## APPENDIX B Figure 1

### COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT AIR POLLUTION CONTROL DIVISION - SAMPLING LOCATIONS



| <u>Site</u> | <u>Location</u>                                                                                                                                                                             |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| X-1         | 16600 West Highway 128 --- Rocky Flats north property boundary, outside of boundary fence on the south side of Colorado Highway 128, approximately 1.3 miles to the west of Indiana Street. |
| X-2         | 11501 Indiana Street --- Rocky Flats east property boundary, outside the boundary fence on the west side of Indiana Street, approximately 1 mile north of the Rocky Flats East access road. |
| X-3         | 9901 Indiana Street --- Rocky Flats east property boundary, outside the boundary fence on the west side of Indiana Street, approximately 1 mile south of the Rocky Flats East access road.  |
| X-4         | 18000 West Highway 72 --- On south side of Colorado Highway 72 on south edge of an unused parking lot, approximately 2 miles east of Colorado Highway 93.                                   |
| X-5         | 11190 Highway 93 --- On east side of Colorado Highway 93 and south side of 112 <sup>th</sup> Avenue, approximately 1 mile north of the Rocky Flats West access road.                        |

**APPENDIX B**  
**Figure 2**



**COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT**  
**AIR POLLUTION CONTROL DIVISION - COMPARISON SITES**

**Site**

Rocky Flats - N (X-1)  
Rocky Flats - NE (X-2)  
Rocky Flats - SE (X-3)  
Rocky Flats - S (X-4)  
Rocky Flats - W (X-5)  
CAMP  
Welby  
Commerce City  
Arvada  
NREL (South Table Mtn.)  
Boulder Chamber - Particulate  
South Boulder Creek

**Location**

16600 West Highway 128  
11501 Indiana Street  
9901 Indiana Street  
18000 West Highway 72  
11190 Highway 93  
2105 Broadway, Denver  
78<sup>th</sup> Avenue and Steele Street  
7101 Birch Street  
57<sup>th</sup> Avenue and Garrison Street  
20<sup>th</sup> Avenue & Quaker Street  
2440 Pearl Street  
1405 1/2 South Foothills Highway

## **APPENDIX C**

# **TOTAL SUSPENDED PARTICULATE DATA**

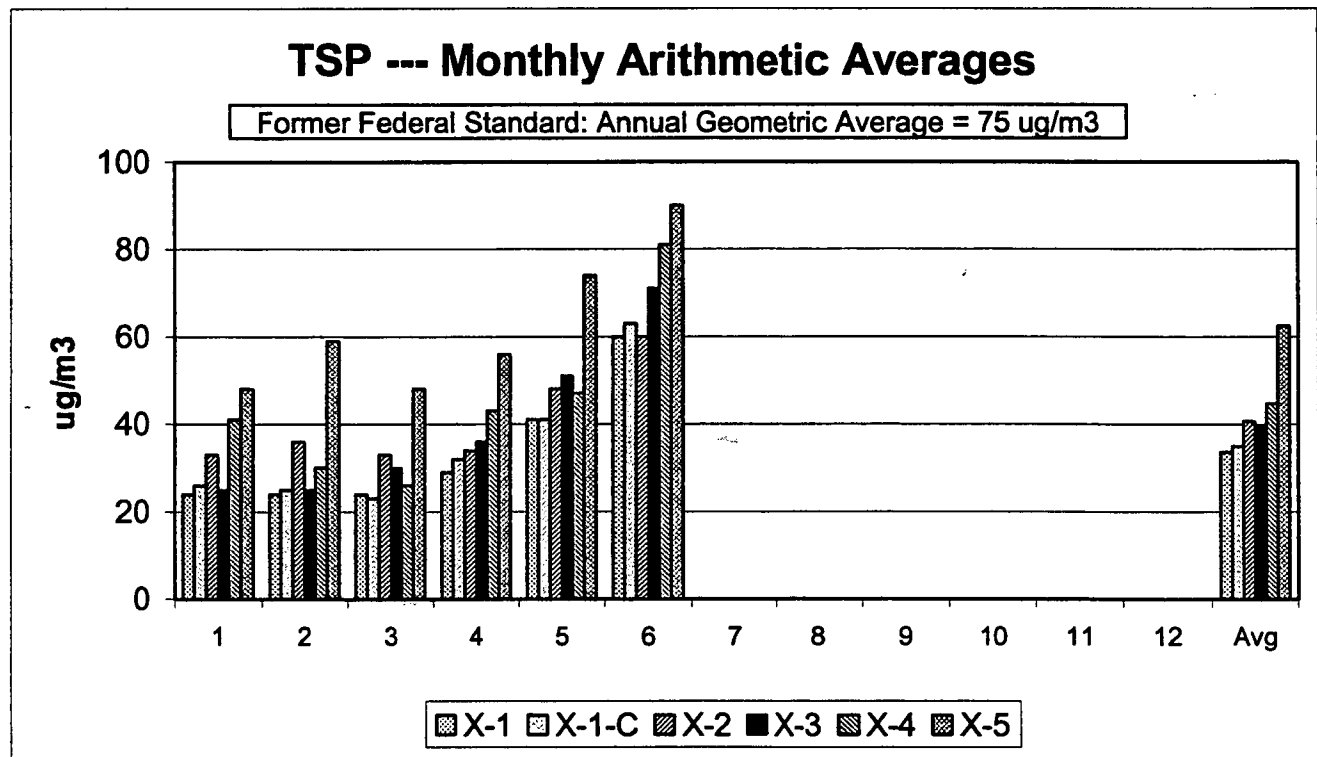
# AIR MONITORING AT RFETS

## Total Suspended Particulates 2001

### Monthly Arithmetic Average Data ( $\mu\text{g}/\text{m}^3$ )

|       | 2001 | Month |    |    |    |    |   |   |   |    |    |    | 2001 |
|-------|------|-------|----|----|----|----|---|---|---|----|----|----|------|
| Site  | 1    | 2     | 3  | 4  | 5  | 6  | 7 | 8 | 9 | 10 | 11 | 12 | Avg  |
| X-1   | 24   | 24    | 24 | 29 | 41 | 60 | X | X | X | X  | X  | X  | 34   |
| X-1-C | 26   | 25    | 23 | 32 | 41 | 63 | X | X | X | X  | X  | X  | 35   |
| X-2   | 33   | 36    | 33 | 34 | 48 | 60 | X | X | X | X  | X  | X  | 41   |
| X-3   | 25   | 25    | 30 | 36 | 51 | 71 | X | X | X | X  | X  | X  | 40   |
| X-4   | 41   | 30    | 26 | 43 | 47 | 81 | X | X | X | X  | X  | X  | 45   |
| X-5   | 48   | 59    | 48 | 56 | 74 | 90 | X | X | X | X  | X  | X  | 63   |

X = Not Available. Sampling terminated at the end of June 2001.



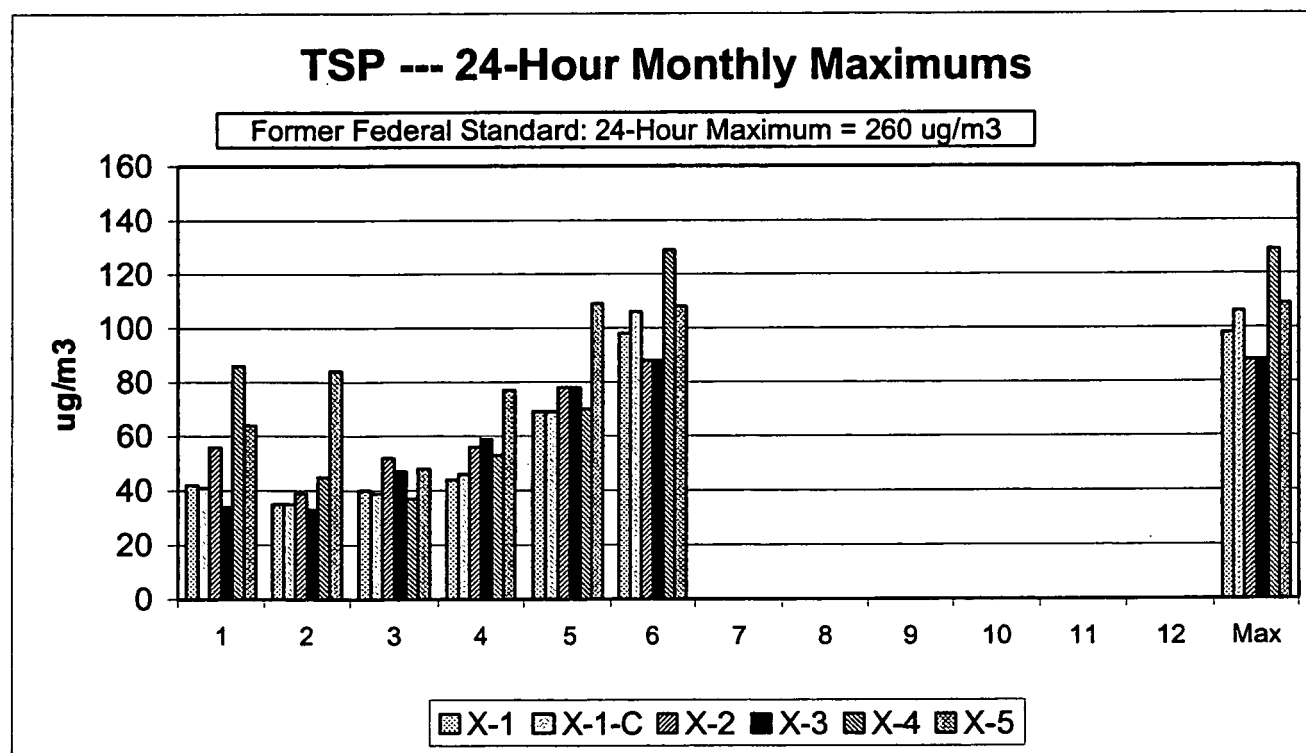
# AIR MONITORING AT RFETS

## Total Suspended Particulates 2001

### Monthly 24 Hour Maximum Data (ug/m3)

| 2001 Months |    |    |    |    |     |     |   |   |   |    |    |    | 2001 |
|-------------|----|----|----|----|-----|-----|---|---|---|----|----|----|------|
| Site        | 1  | 2  | 3  | 4  | 5   | 6   | 7 | 8 | 9 | 10 | 11 | 12 | Max  |
| X-1         | 42 | 35 | 40 | 44 | 69  | 98  | X | X | X | X  | X  | X  | 98   |
| X-1-C       | 41 | 35 | 39 | 46 | 69  | 106 | X | X | X | X  | X  | X  | 106  |
| X-2         | 56 | 39 | 52 | 56 | 78  | 88  | X | X | X | X  | X  | X  | 88   |
| X-3         | 34 | 33 | 47 | 59 | 78  | 88  | X | X | X | X  | X  | X  | 88   |
| X-4         | 86 | 45 | 37 | 53 | 70  | 129 | X | X | X | X  | X  | X  | 129  |
| X-5         | 64 | 84 | 48 | 77 | 109 | 108 | X | X | X | X  | X  | X  | 109  |

X = Not Available. Sampling terminated at the end of June 2001.



# AIR MONITORING AT RFETS

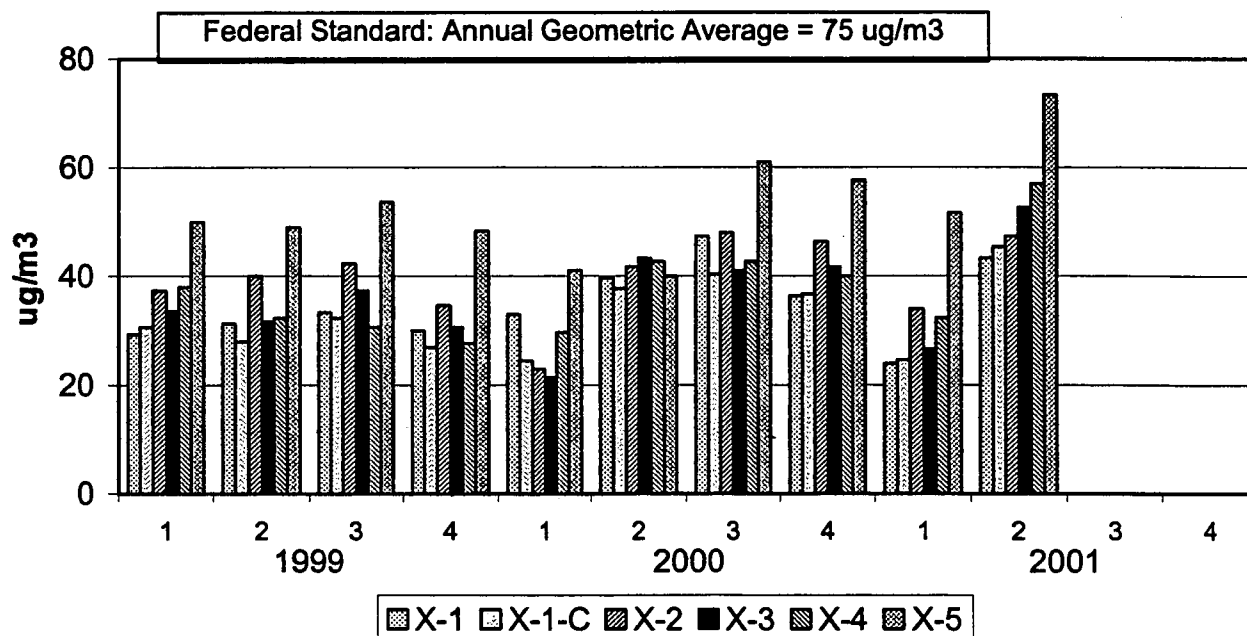
## Total Suspended Particulates 2001

### Quarterly Arithmetic Average Data (3 years) ug/m<sup>3</sup>

|      | 1999 |    |    |    | 2000 |    |    |    | 2001 |    |   |   |
|------|------|----|----|----|------|----|----|----|------|----|---|---|
| Site | 1    | 2  | 3  | 4  | 1    | 2  | 3  | 4  | 1    | 2  | 3 | 4 |
| X-1  | 29   | 31 | 33 | 30 | 33   | 40 | 47 | 36 | 24   | 43 | X | X |
| X-1C | 31   | 28 | 32 | 27 | 22   | 38 | 40 | 37 | 25   | 45 | X | X |
| X-2  | 37   | 40 | 42 | 35 | 23   | 42 | 48 | 46 | 34   | 47 | X | X |
| X-3  | 34   | 32 | 37 | 31 | 22   | 43 | 41 | 42 | 27   | 53 | X | X |
| X-4  | 38   | 32 | 31 | 28 | 30   | 43 | 43 | 40 | 32   | 57 | X | X |
| X-5  | 50   | 49 | 54 | 48 | 41   | 40 | 61 | 58 | 52   | 73 | X | X |

X = Not Available. Sampling terminated at the end of June 2001.

### TSP --- Quarterly Arithmetic Averages



# **APPENDIX D**

## **PM<sub>10</sub> DATA**

# AIR MONITORING AT RFETS

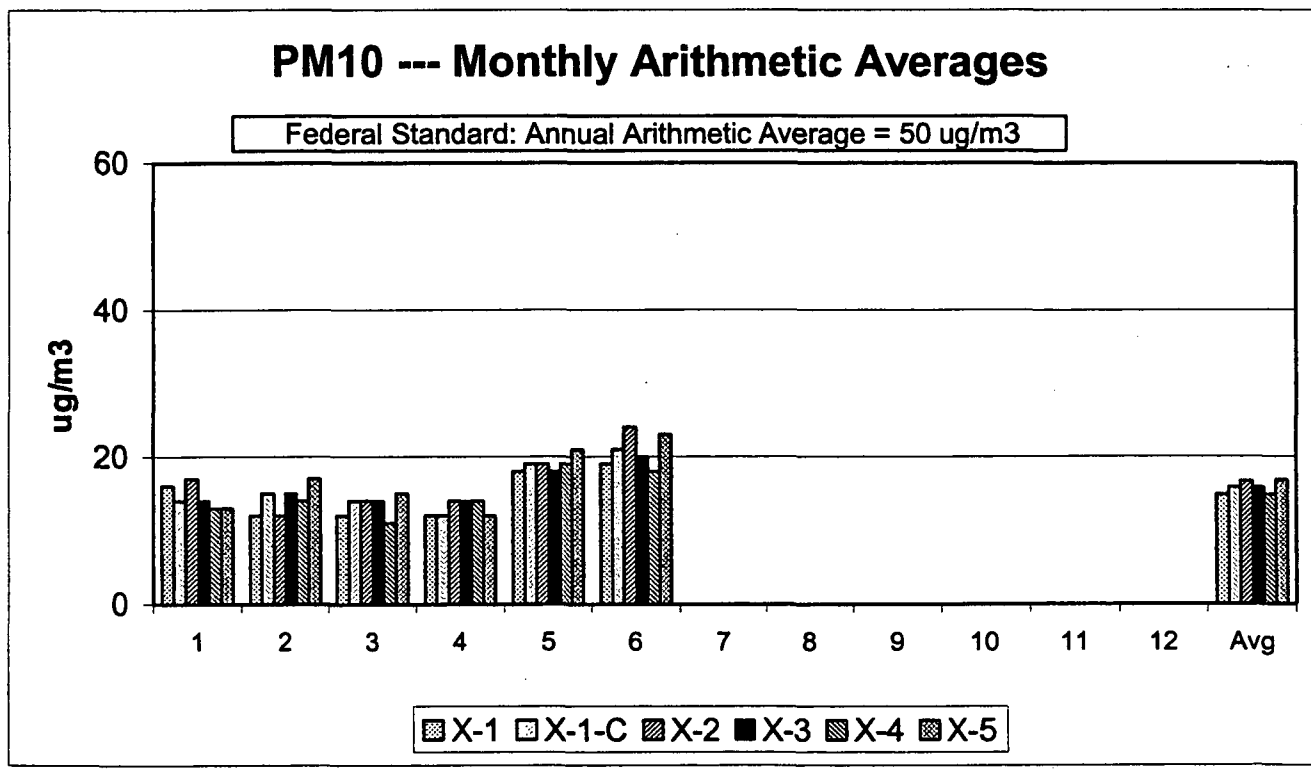
**PM<sub>10</sub>**

**2001**

**Monthly Arithmetic Average Data  
( $\mu\text{g}/\text{m}^3$ )**

|       | 2001 | Month |    |    |    |    |   |   |   |    |    |    | 2001 |
|-------|------|-------|----|----|----|----|---|---|---|----|----|----|------|
| Site  | 1    | 2     | 3  | 4  | 5  | 6  | 7 | 8 | 9 | 10 | 11 | 12 | Avg  |
| X-1   | 16   | 12    | 12 | 12 | 18 | 19 | X | X | X | X  | X  | X  | 15   |
| X-2   | 14   | 15    | 14 | 12 | 19 | 21 | X | X | X | X  | X  | X  | 16   |
| X-2-C | 17   | 12    | 14 | 14 | 19 | 24 | X | X | X | X  | X  | X  | 17   |
| X-3   | 14   | 15    | 14 | 14 | 18 | 20 | X | X | X | X  | X  | X  | 16   |
| X-4   | 13   | 14    | 11 | 14 | 19 | 18 | X | X | X | X  | X  | X  | 15   |
| X-5   | 13   | 17    | 15 | 12 | 21 | 23 | X | X | X | X  | X  | X  | 17   |

X = Not Available. Sampling terminated at the end of June 2001.





# AIR MONITORING AT RFETS

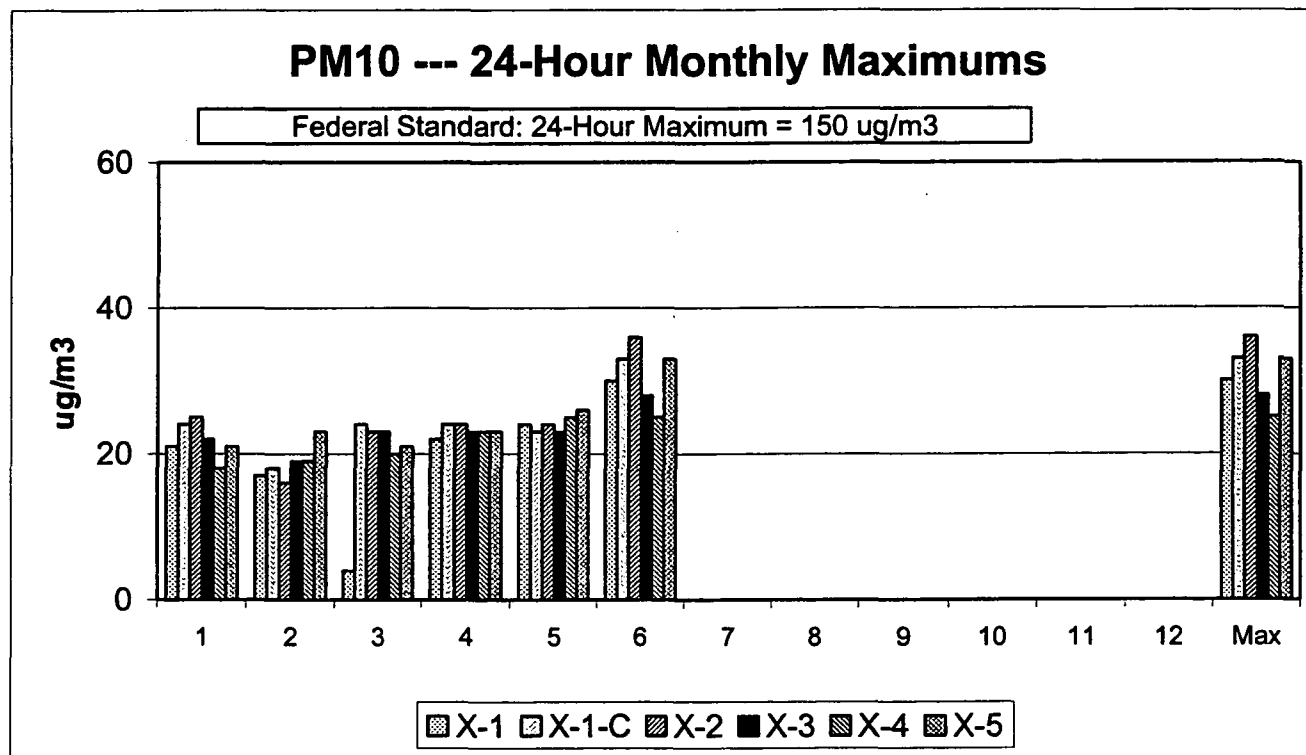
**PM<sub>10</sub>**

**2001**

## Monthly 24-Hour Maximum Data ( $\mu\text{g}/\text{m}^3$ )

|       | 2001 | Month |    |    |    |    |   |   |   |    |    |    | 2001 |
|-------|------|-------|----|----|----|----|---|---|---|----|----|----|------|
| Site  | 1    | 2     | 3  | 4  | 5  | 6  | 7 | 8 | 9 | 10 | 11 | 12 | Avg  |
| X-1   | 21   | 17    | 4  | 22 | 24 | 30 | X | X | X | X  | X  | X  | 30   |
| X-2   | 24   | 18    | 24 | 24 | 23 | 33 | X | X | X | X  | X  | X  | 33   |
| X-2-C | 25   | 16    | 23 | 24 | 24 | 36 | X | X | X | X  | X  | X  | 36   |
| X-3   | 22   | 19    | 23 | 23 | 23 | 28 | X | X | X | X  | X  | X  | 28   |
| X-4   | 18   | 19    | 20 | 23 | 25 | 25 | X | X | X | X  | X  | X  | 25   |
| X-5   | 21   | 23    | 21 | 23 | 26 | 33 | X | X | X | X  | X  | X  | 33   |

X = Not Available. Sampling terminated at the end of June 2001.



# AIR MONITORING AT RFETS

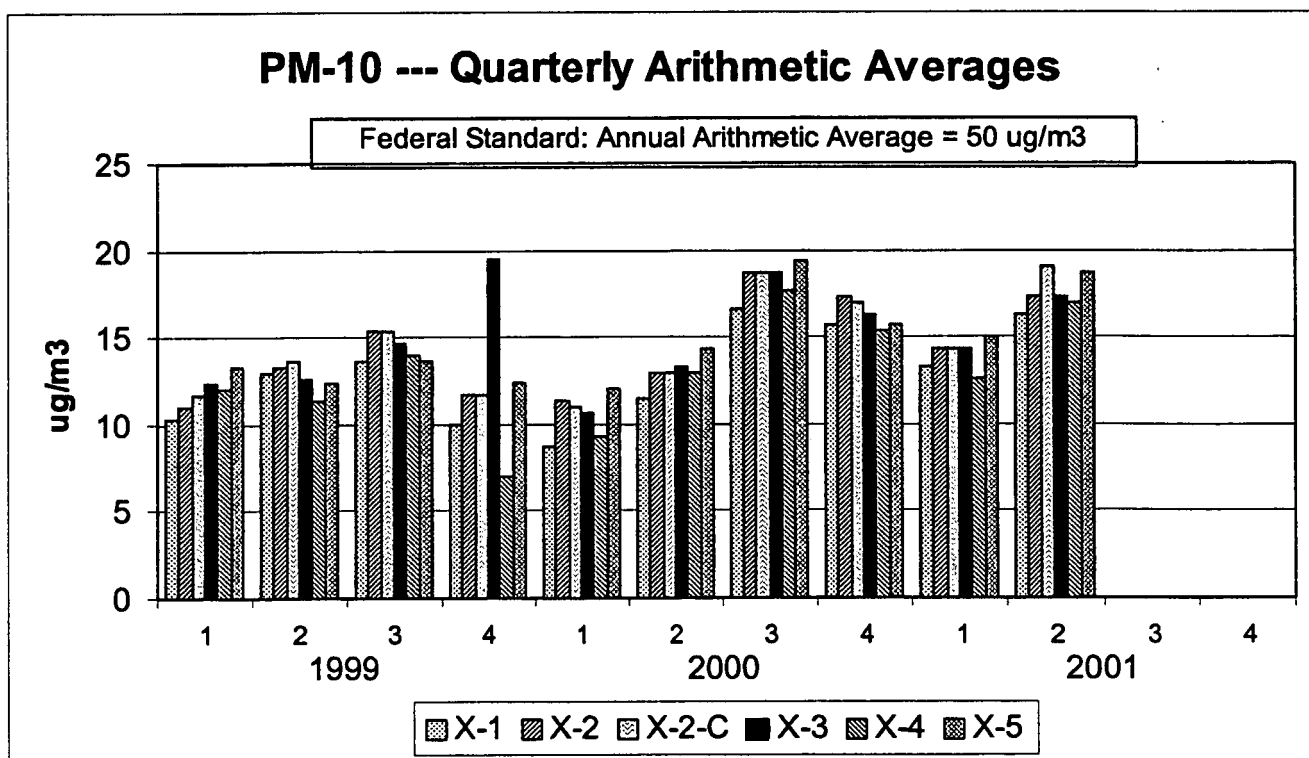
PM<sub>10</sub>

2000

Quarterly Arithmetic Average Data (3-years)  
( $\mu\text{g}/\text{m}^3$ )

|       | 1999 |    |    |    | 2000 |    |    |    | 2001 |    |   |   |
|-------|------|----|----|----|------|----|----|----|------|----|---|---|
| Site  | 1    | 2  | 3  | 4  | 1    | 2  | 3  | 4  | 1    | 2  | 3 | 4 |
| X-1   | 10   | 13 | 14 | 10 | 9    | 12 | 17 | 16 | 13   | 16 | X | X |
| X-2   | 11   | 13 | 15 | 12 | 11   | 13 | 19 | 17 | 14   | 17 | X | X |
| X-2-C | 12   | 14 | 15 | 12 | 11   | 13 | 19 | 17 | 14   | 19 | X | X |
| X-3   | 12   | 13 | 15 | 20 | 11   | 13 | 19 | 16 | 14   | 17 | X | X |
| X-4   | 12   | 11 | 14 | 7  | 9    | 13 | 18 | 15 | 13   | 17 | X | X |
| X-5   | 13   | 12 | 14 | 12 | 12   | 14 | 19 | 16 | 15   | 19 | X | X |

X = Not Available. Sampling terminated at the end of June 2001.



**APPENDIX E**

**OXIDES OF  
NITROGEN DATA**

# AIR MONITORING AT RFETS

## Nitric Oxide (NO)

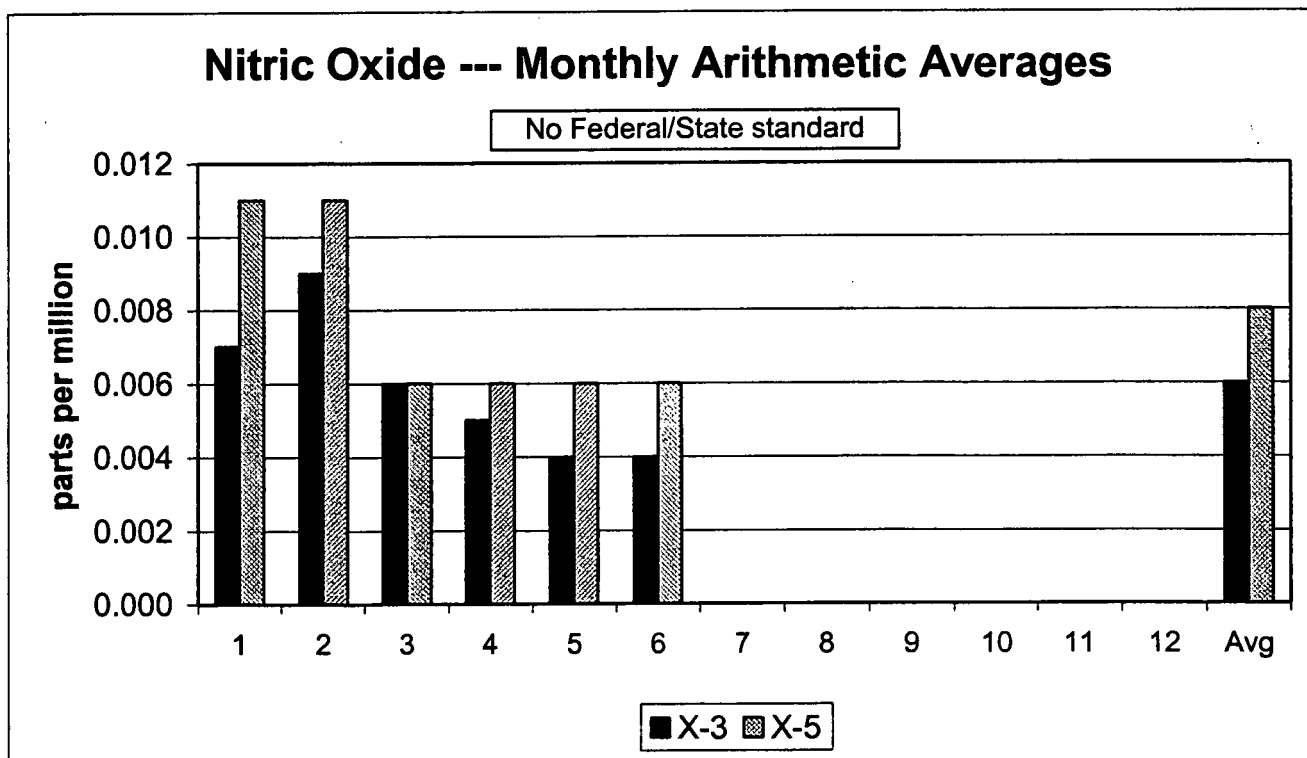
2001

### Monthly Arithmetic Average Data

(ppm)

|      | 2001  | Month |       |       |       |       |   |   |   |    |    |    | 2001  |
|------|-------|-------|-------|-------|-------|-------|---|---|---|----|----|----|-------|
| Site | 1     | 2     | 3     | 4     | 5     | 6     | 7 | 8 | 9 | 10 | 11 | 12 | Avg   |
| X-3  | 0.007 | 0.009 | 0.006 | 0.005 | 0.004 | 0.004 | X | X | X | X  | X  | X  | 0.006 |
| X-5  | 0.011 | 0.011 | 0.006 | 0.006 | 0.006 | 0.006 | X | X | X | X  | X  | X  | 0.008 |

X = Not Available. Sampling terminated at the end of June 2001.



# AIR MONITORING AT RFETS

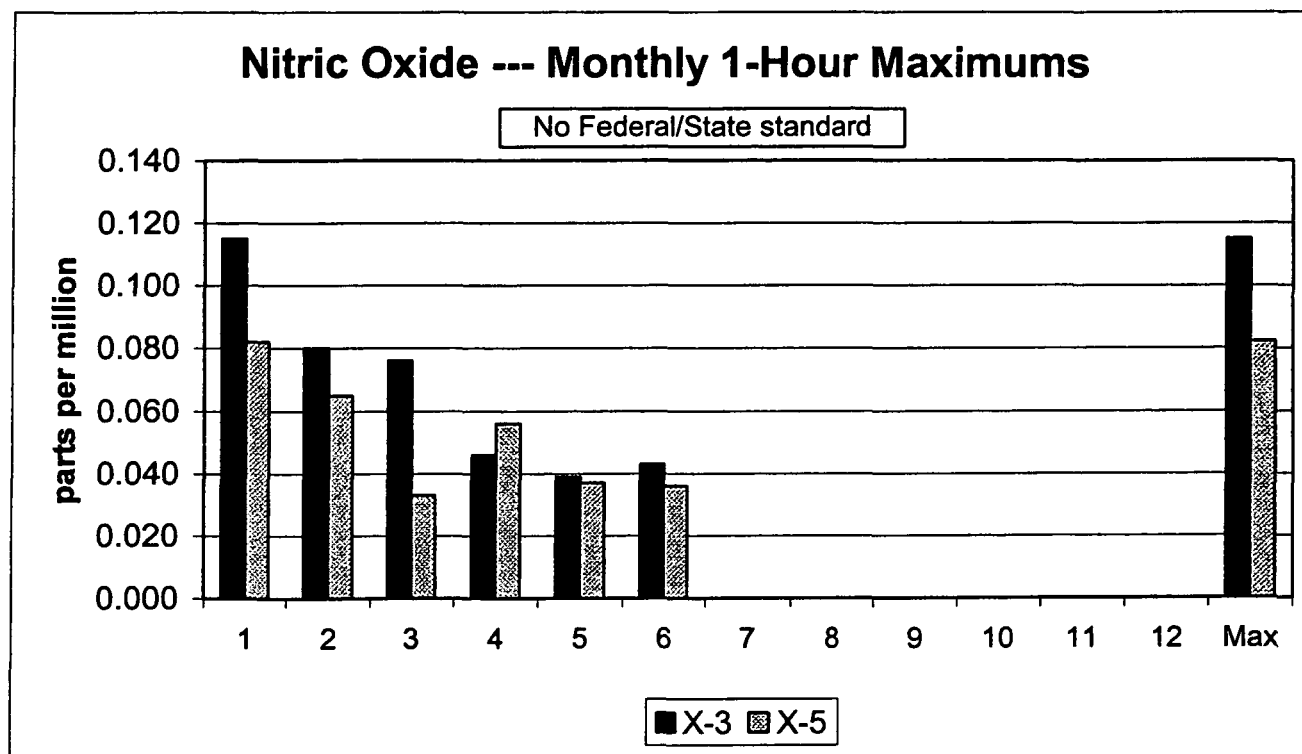
## Nitric Oxide (NO)

2001

### Monthly 1-Hour Maximum Data (ppm)

|      | 2001  | Month |       |       |       |       |   |   |   |    |    |    | 2001  |
|------|-------|-------|-------|-------|-------|-------|---|---|---|----|----|----|-------|
| Site | 1     | 2     | 3     | 4     | 5     | 6     | 7 | 8 | 9 | 10 | 11 | 12 | Max   |
| X-3  | 0.115 | 0.080 | 0.076 | 0.046 | 0.039 | 0.043 | X | X | X | X  | X  | X  | 0.115 |
| X-5  | 0.082 | 0.065 | 0.033 | 0.056 | 0.037 | 0.036 | X | X | X | X  | X  | X  | 0.082 |

X = Not Available. Sampling terminated at the end of June 2001.



# AIR MONITORING AT RFETS

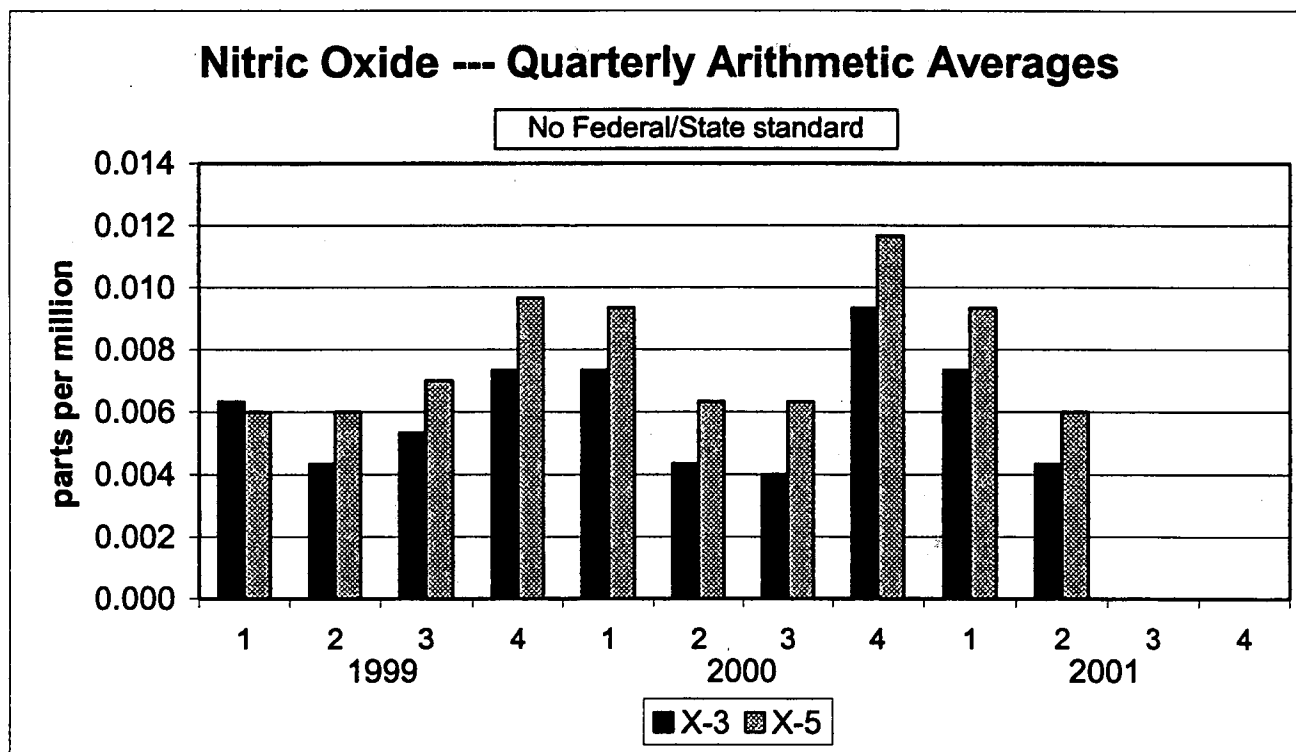
## Nitric Oxide (NO)

2001

### Quarterly Arithmetic Average Data (3-years) (ppm)

|      | 1999  |       |       |       | 2000  |       |       |       | 2001 |      |   |   |
|------|-------|-------|-------|-------|-------|-------|-------|-------|------|------|---|---|
| Site | 1     | 2     | 3     | 4     | 1     | 2     | 3     | 4     | 1    | 2    | 3 | 4 |
| X-3  | 0.006 | 0.004 | 0.005 | 0.007 | 0.007 | 0.004 | 0.004 | 0.009 | .007 | .004 | X | X |
| X-5  | 0.006 | 0.006 | 0.007 | 0.010 | 0.009 | 0.006 | 0.006 | 0.012 | .009 | .006 | X | X |

X = Not Available. Sampling terminated at the end of June 2001.



# **AIR MONITORING AT RFETS**

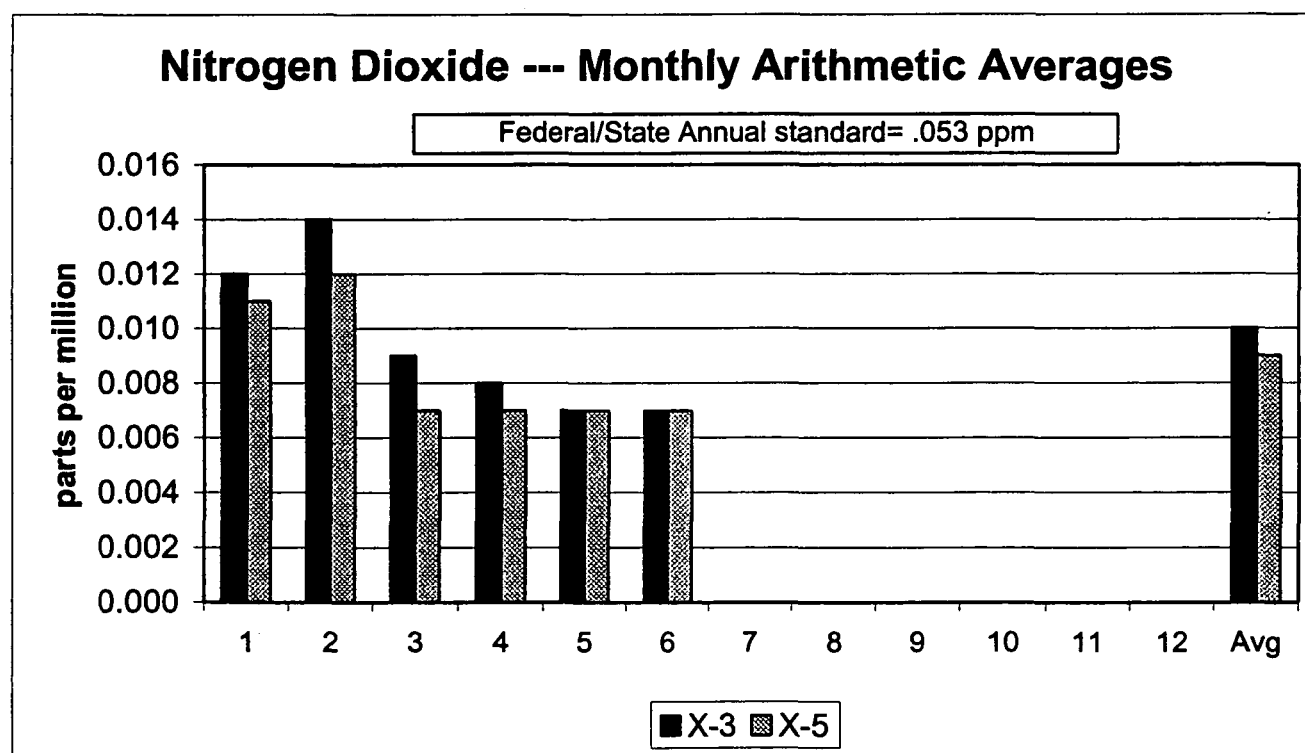
## **Nitrogen Dioxide (NO<sub>2</sub>)**

**2001**

### **Monthly Arithmetic Average Data (ppm)**

|      | 2001  | Month |       |       |       |       |   |   |   |    |    |    | 2001  |
|------|-------|-------|-------|-------|-------|-------|---|---|---|----|----|----|-------|
| Site | 1     | 2     | 3     | 4     | 5     | 6     | 7 | 8 | 9 | 10 | 11 | 12 | Avg   |
| X-3  | 0.012 | 0.014 | 0.009 | 0.008 | 0.007 | 0.007 | X | X | X | X  | X  | X  | 0.010 |
| X-5  | 0.011 | 0.012 | 0.007 | 0.007 | 0.007 | 0.007 | X | X | X | X  | X  | X  | 0.009 |

X = Not Available. Sampling terminated at the end of June 2001.



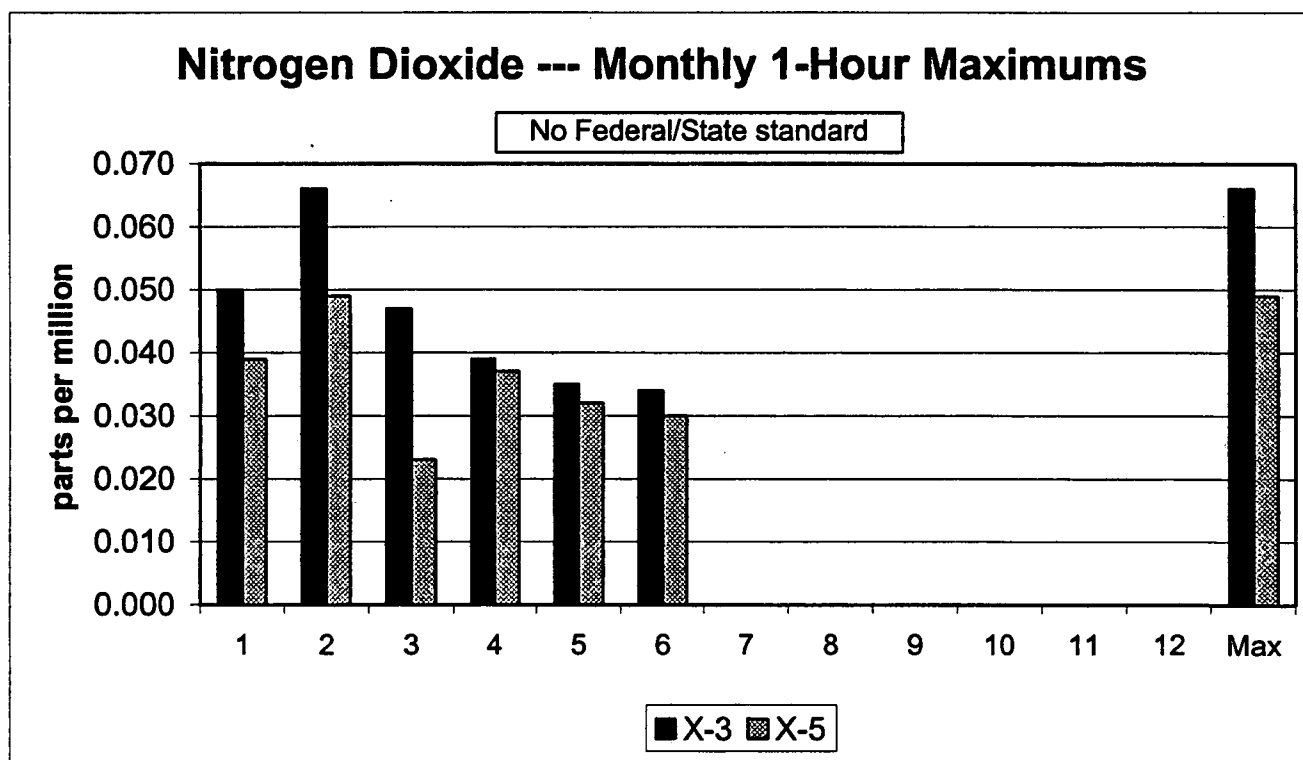
# **AIR MONITORING AT RFETS**

## **Nitrogen Dioxide (NO<sub>2</sub>) 2001**

### **Monthly 1-Hour Maximum Data (ppm)**

|      | 2001  | Month |       |       |       |       |   |   |   |    |    |    | 2001  |
|------|-------|-------|-------|-------|-------|-------|---|---|---|----|----|----|-------|
| Site | 1     | 2     | 3     | 4     | 5     | 6     | 7 | 8 | 9 | 10 | 11 | 12 | Max   |
| X-3  | 0.050 | 0.066 | 0.047 | 0.039 | 0.035 | 0.034 | X | X | X | X  | X  | X  | 0.066 |
| X-5  | 0.039 | 0.049 | 0.023 | 0.037 | 0.032 | 0.030 | X | X | X | X  | X  | X  | 0.049 |

X = Not Available. Sampling terminated at the end of June 2001.





# AIR MONITORING AT RFETS

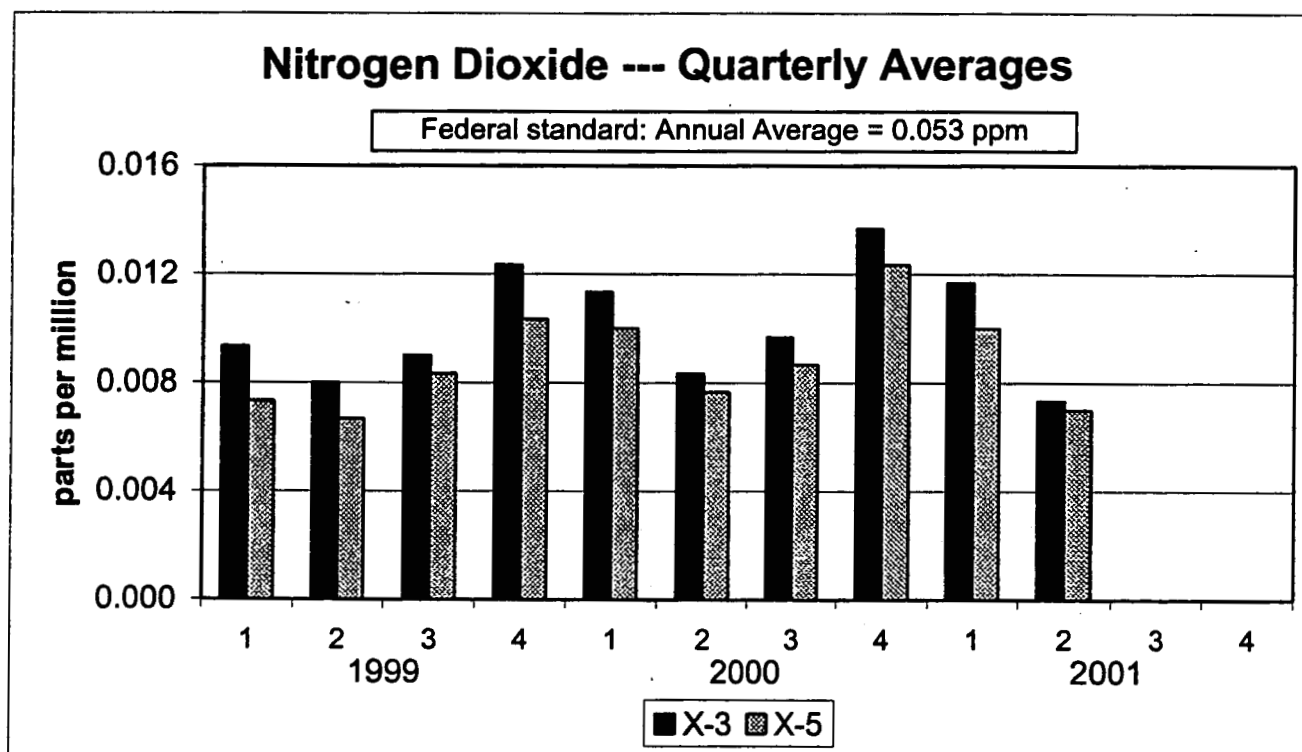
## Nitrogen Dioxide (NO<sub>2</sub>)

2001

### Quarterly Arithmetic Average Data (3-years) (ppm)

|      | 1999  |       |       |       | 2000  |       |       |       | 2001 |      |   |   |
|------|-------|-------|-------|-------|-------|-------|-------|-------|------|------|---|---|
| Site | 1     | 2     | 3     | 4     | 1     | 2     | 3     | 4     | 1    | 2    | 3 | 4 |
| X-3  | 0.009 | 0.008 | 0.009 | 0.012 | 0.011 | 0.008 | 0.010 | 0.014 | .012 | .007 | X | X |
| X-5  | 0.007 | 0.007 | 0.008 | 0.010 | 0.010 | 0.008 | 0.009 | 0.012 | .010 | .007 | X | X |

X = Not Available. Sampling terminated at the end of June 2001.



**APPENDIX F**

**VOLATILE ORGANIC  
COMPOUNDS DATA**

# **AIR MONITORING AT RFETS**

## **Volatile Organic Compounds (VOCs)**

**2001**

**Monthly Arithmetic Average Data  
(In Parts Per Billion)**

Data are in parts per billion.

## 2001 Months

2001

| Site | Compound                    | Mol. Wt. | 1    | 2    | 3    | 4    | 5    | 6    | 7 | 8 | 9 | 10 | 11 | 12 | Avg  |
|------|-----------------------------|----------|------|------|------|------|------|------|---|---|---|----|----|----|------|
| X-1  | Freon 134a                  | 102.03   | 0.07 | 0.00 | 0.01 | 0.50 | 0.00 | 0.00 | X | X | X | X  | X  | X  | 0.10 |
| X-2  | (1,1,1,2-Tetrafluoroethane) | 102.03   | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X  | X  | X  | 0.00 |
| X-3  | CAS # 811-97-2              | 102.03   | 0.02 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X  | X  | X  | 0.01 |
| X-4  |                             | 102.03   | 0.05 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | X | X | X | X  | X  | X  | 0.01 |
| X-5  |                             | 102.03   | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X  | X  | X  | 0.00 |
| X-1  | Freon 22                    | 86.47    | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X  | X  | X  | 0.00 |
| X-2  | (Chlorodifluoromethane)     | 86.47    | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | X | X | X | X  | X  | X  | 0.01 |
| X-3  | CAS # 75-45-6               | 86.47    | 0.01 | 0.00 | 0.00 | 0.01 | 0.00 | 0.02 | X | X | X | X  | X  | X  | 0.01 |
| X-4  |                             | 86.47    | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X  | X  | X  | 0.00 |
| X-5  |                             | 86.47    | 0.01 | 0.00 | 0.02 | 0.27 | 0.01 | 0.02 | X | X | X | X  | X  | X  | 0.06 |
| X-1  | Freon 12                    | 120.91   | 0.48 | 0.52 | 0.47 | 0.35 | 0.44 | 0.41 | X | X | X | X  | X  | X  | 0.45 |
| X-2  | (Dichlorodifluoromethane)   | 120.91   | 0.40 | 0.40 | 0.34 | 0.21 | 0.30 | 0.30 | X | X | X | X  | X  | X  | 0.33 |
| X-3  | CAS # 75-71-8               | 120.91   | 0.31 | 0.39 | 0.38 | 0.22 | 0.26 | 0.27 | X | X | X | X  | X  | X  | 0.31 |
| X-4  |                             | 120.91   | 0.35 | 0.39 | 0.33 | 0.18 | 0.31 | 0.26 | X | X | X | X  | X  | X  | 0.30 |
| X-5  |                             | 120.91   | 0.31 | 0.31 | 0.30 | 0.18 | 0.27 | 0.28 | X | X | X | X  | X  | X  | 0.28 |
| X-1  | Chloromethane               | 50.49    | 0.12 | 0.15 | 0.06 | 0.09 | 0.04 | 0.00 | X | X | X | X  | X  | X  | 0.08 |
| X-2  | (Methyl chloride)           | 50.49    | 0.05 | 0.06 | 0.05 | 0.03 | 0.03 | 0.00 | X | X | X | X  | X  | X  | 0.04 |
| X-3  | CAS # 74-87-3               | 50.49    | 0.06 | 0.06 | 0.04 | 0.02 | 0.00 | 0.00 | X | X | X | X  | X  | X  | 0.03 |
| X-4  |                             | 50.49    | 0.09 | 0.09 | 0.03 | 0.05 | 0.01 | 0.00 | X | X | X | X  | X  | X  | 0.05 |
| X-5  |                             | 50.49    | 0.09 | 0.06 | 0.05 | 0.01 | 0.00 | 0.00 | X | X | X | X  | X  | X  | 0.04 |
| X-1  | Freon 114                   | 170.92   | 0.02 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | X | X | X | X  | X  | X  | 0.01 |
| X-2  | (1,2-Dichloro-              | 170.92   | 0.01 | 0.01 | 0.00 | 0.00 | 0.01 | 0.00 | X | X | X | X  | X  | X  | 0.01 |
| X-3  | 1,1,2,2-tetrafluoroethane)  | 170.92   | 0.01 | 0.00 | 0.01 | 0.00 | 0.01 | 0.01 | X | X | X | X  | X  | X  | 0.01 |
| X-4  | CAS # 76-14-2               | 170.92   | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X  | X  | X  | 0.00 |
| X-5  |                             | 170.92   | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X  | X  | X  | 0.00 |
| X-1  | Vinyl chloride              | 62.50    | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X  | X  | X  | 0.00 |
| X-2  | CAS # 75-01-4               | 62.50    | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X  | X  | X  | 0.00 |
| X-3  |                             | 62.50    | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X  | X  | X  | 0.00 |
| X-4  |                             | 62.50    | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X  | X  | X  | 0.00 |
| X-5  |                             | 62.50    | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X  | X  | X  | 0.00 |

|     |                                                                         |        |      |      |      |      |      |      |   |   |   |   |   |   |      |
|-----|-------------------------------------------------------------------------|--------|------|------|------|------|------|------|---|---|---|---|---|---|------|
| X-1 | 1,3-Butadiene<br>CAS # 106-99-0                                         | 54.09  | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-2 |                                                                         | 54.09  | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-3 |                                                                         | 54.09  | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-4 |                                                                         | 54.09  | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-5 |                                                                         | 54.09  | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-1 | Chloroethane<br>(Ethyl chloride)<br>CAS # 75-00-3                       | 64.52  | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-2 |                                                                         | 64.52  | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-3 |                                                                         | 64.52  | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-4 |                                                                         | 64.52  | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-5 |                                                                         | 64.52  | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-1 | Freon 123<br>(2,2-Dichloro-<br>1,1,1-trifluoroethane)<br>CAS # 306-83-2 | 152.93 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-2 |                                                                         | 152.93 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-3 |                                                                         | 152.93 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-4 |                                                                         | 152.93 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-5 |                                                                         | 152.93 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-1 | Freon 11<br>(Trichlorofluoromethane)<br>CAS # 75-69-4                   | 137.37 | 0.12 | 0.08 | 0.07 | 0.04 | 0.05 | 0.06 | X | X | X | X | X | X | 0.07 |
| X-2 |                                                                         | 137.37 | 0.12 | 0.12 | 0.10 | 0.07 | 0.08 | 0.08 | X | X | X | X | X | X | 0.10 |
| X-3 |                                                                         | 137.37 | 0.11 | 0.10 | 0.10 | 0.07 | 0.08 | 0.09 | X | X | X | X | X | X | 0.09 |
| X-4 |                                                                         | 137.37 | 0.12 | 0.13 | 0.08 | 0.05 | 0.07 | 0.06 | X | X | X | X | X | X | 0.09 |
| X-5 |                                                                         | 137.37 | 0.08 | 0.05 | 0.05 | 0.09 | 0.04 | 0.04 | X | X | X | X | X | X | 0.06 |
| X-1 | Vinylidene chloride<br>(1,1-Dichloroethene)<br>CAS # 75-35-4            | 96.94  | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-2 |                                                                         | 96.94  | 0.02 | 0.03 | 0.01 | 0.01 | 0.01 | 0.00 | X | X | X | X | X | X | 0.01 |
| X-3 |                                                                         | 96.94  | 0.02 | 0.02 | 0.01 | 0.01 | 0.01 | 0.00 | X | X | X | X | X | X | 0.01 |
| X-4 |                                                                         | 96.94  | 0.03 | 0.03 | 0.00 | 0.02 | 0.01 | 0.00 | X | X | X | X | X | X | 0.02 |
| X-5 |                                                                         | 96.94  | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-1 | Dichloromethane<br>(Methylene chloride)<br>CAS # 75-09-2                | 84.93  | 0.03 | 0.05 | 0.18 | 0.04 | 0.05 | 0.01 | X | X | X | X | X | X | 0.06 |
| X-2 |                                                                         | 84.93  | 0.08 | 0.10 | 0.09 | 0.05 | 0.09 | 0.03 | X | X | X | X | X | X | 0.07 |
| X-3 |                                                                         | 84.93  | 0.06 | 0.09 | 0.13 | 0.05 | 0.08 | 0.03 | X | X | X | X | X | X | 0.07 |
| X-4 |                                                                         | 84.93  | 0.05 | 0.09 | 0.03 | 0.03 | 0.08 | 0.04 | X | X | X | X | X | X | 0.05 |
| X-5 |                                                                         | 84.93  | 0.02 | 0.04 | 0.01 | 0.04 | 0.04 | 0.02 | X | X | X | X | X | X | 0.03 |

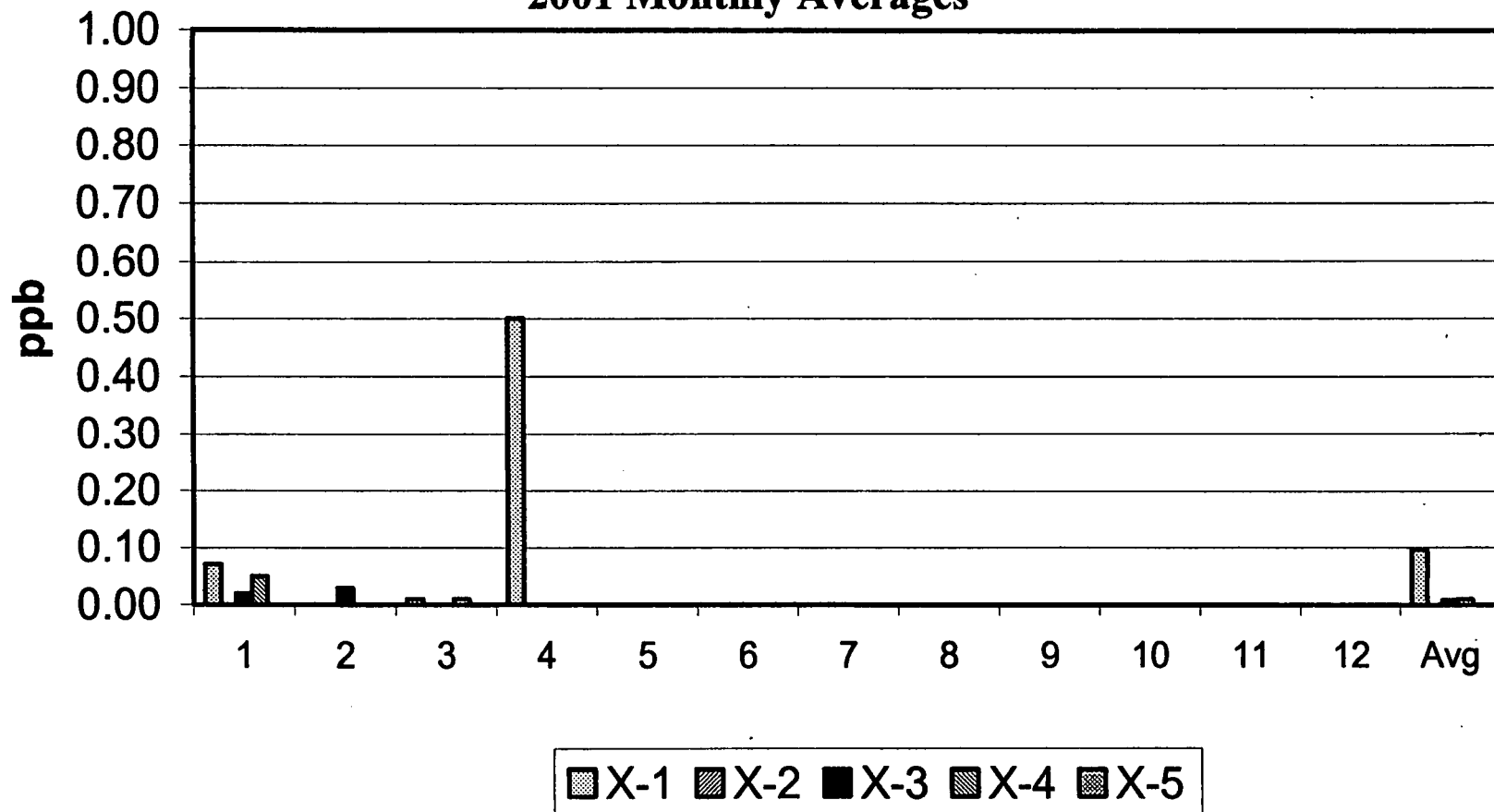
|     |                                                                            |        |      |      |      |      |      |      |   |   |   |   |   |   |      |
|-----|----------------------------------------------------------------------------|--------|------|------|------|------|------|------|---|---|---|---|---|---|------|
| X-1 | Freon 113<br>(1,1,2-Trichloro-<br>(1,2,2-trifluoroethane)<br>CAS # 76-13-1 | 187.38 | 0.08 | 0.07 | 0.08 | 0.07 | 0.06 | 0.06 | X | X | X | X | X | X | 0.07 |
| X-2 |                                                                            | 187.38 | 0.08 | 0.08 | 0.09 | 0.06 | 0.07 | 0.07 | X | X | X | X | X | X | 0.08 |
| X-3 |                                                                            | 187.38 | 0.08 | 0.08 | 0.09 | 0.07 | 0.07 | 0.07 | X | X | X | X | X | X | 0.08 |
| X-4 |                                                                            | 187.38 | 0.08 | 0.09 | 0.09 | 0.07 | 0.07 | 0.06 | X | X | X | X | X | X | 0.08 |
| X-5 |                                                                            | 187.38 | 0.06 | 0.05 | 0.05 | 0.04 | 0.04 | 0.04 | X | X | X | X | X | X | 0.05 |
| X-1 | Methyl tert-butyl ether<br>(MTBE)<br>CAS # 1634-04-4                       | 88.15  | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-2 |                                                                            | 88.15  | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-3 |                                                                            | 88.15  | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-4 |                                                                            | 88.15  | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-5 |                                                                            | 88.15  | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-1 | 1,1-Dichloroethane<br>CAS # 75-34-3                                        | 98.96  | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-2 |                                                                            | 98.96  | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-3 |                                                                            | 98.96  | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-4 |                                                                            | 98.96  | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-5 |                                                                            | 98.96  | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-1 | Chloroform<br>CAS # 67-66-3                                                | 119.38 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-2 |                                                                            | 119.38 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-3 |                                                                            | 119.38 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-4 |                                                                            | 119.38 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-5 |                                                                            | 119.38 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-1 | 1,2-Dichloroethane<br>(Ethylene dichloride)<br>CAS # 107-06-2              | 98.96  | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-2 |                                                                            | 98.96  | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-3 |                                                                            | 98.96  | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-4 |                                                                            | 98.96  | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-5 |                                                                            | 98.96  | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-1 | 1,1,1-Trichloroethane<br>(Methylchloroform)<br>CAS # 71-55-6               | 133.41 | 0.04 | 0.02 | 0.01 | 0.00 | 0.01 | 0.02 | X | X | X | X | X | X | 0.02 |
| X-2 |                                                                            | 133.41 | 0.03 | 0.01 | 0.02 | 0.00 | 0.01 | 0.02 | X | X | X | X | X | X | 0.02 |
| X-3 |                                                                            | 133.41 | 0.03 | 0.01 | 0.02 | 0.01 | 0.01 | 0.02 | X | X | X | X | X | X | 0.02 |
| X-4 |                                                                            | 133.41 | 0.04 | 0.02 | 0.02 | 0.02 | 0.02 | 0.01 | X | X | X | X | X | X | 0.02 |
| X-5 |                                                                            | 133.41 | 0.02 | 0.01 | 0.01 | 0.00 | 0.01 | 0.01 | X | X | X | X | X | X | 0.01 |

|     |                                                            |        |      |      |      |      |      |      |   |   |   |   |   |   |      |
|-----|------------------------------------------------------------|--------|------|------|------|------|------|------|---|---|---|---|---|---|------|
| X-1 | Carbon tetrachloride<br>CAS # 56-23-5                      | 153.82 | 0.12 | 0.07 | 0.07 | 0.05 | 0.04 | 0.07 | X | X | X | X | X | X | 0.07 |
| X-2 |                                                            | 153.82 | 0.09 | 0.08 | 0.09 | 0.06 | 0.06 | 0.09 | X | X | X | X | X | X | 0.08 |
| X-3 |                                                            | 153.82 | 0.11 | 0.07 | 0.09 | 0.06 | 0.07 | 0.09 | X | X | X | X | X | X | 0.08 |
| X-4 |                                                            | 153.82 | 0.11 | 0.11 | 0.10 | 0.08 | 0.06 | 0.07 | X | X | X | X | X | X | 0.09 |
| X-5 |                                                            | 153.82 | 0.09 | 0.05 | 0.05 | 0.03 | 0.02 | 0.04 | X | X | X | X | X | X | 0.05 |
| X-1 | Benzene<br>CAS # 71-43-2                                   | 78.12  | 0.23 | 0.23 | 0.18 | 0.06 | 0.09 | 0.07 | X | X | X | X | X | X | 0.14 |
| X-2 |                                                            | 78.12  | 0.31 | 0.41 | 0.33 | 0.11 | 0.22 | 0.15 | X | X | X | X | X | X | 0.26 |
| X-3 |                                                            | 78.12  | 0.29 | 0.34 | 0.31 | 0.13 | 0.23 | 0.16 | X | X | X | X | X | X | 0.24 |
| X-4 |                                                            | 78.12  | 0.29 | 0.35 | 0.19 | 0.13 | 0.19 | 0.12 | X | X | X | X | X | X | 0.21 |
| X-5 |                                                            | 78.12  | 0.17 | 0.17 | 0.15 | 0.07 | 0.09 | 0.08 | X | X | X | X | X | X | 0.12 |
| X-1 | Trichloroethene<br>CAS # 79-01-6                           | 131.29 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-2 |                                                            | 131.29 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-3 |                                                            | 131.29 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-4 |                                                            | 131.29 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-5 |                                                            | 131.29 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-1 | 1,1,2-Trichloroethane<br>CAS # 79-00-5                     | 133.41 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-2 |                                                            | 133.41 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-3 |                                                            | 133.41 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-4 |                                                            | 133.41 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-5 |                                                            | 133.41 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-1 | Toluene (Methyl benzene)<br>CAS # 108-88-3                 | 92.15  | 0.24 | 0.27 | 0.19 | 0.03 | 0.12 | 0.08 | X | X | X | X | X | X | 0.16 |
| X-2 |                                                            | 92.15  | 0.33 | 0.44 | 0.32 | 0.08 | 0.27 | 0.20 | X | X | X | X | X | X | 0.27 |
| X-3 |                                                            | 92.15  | 0.29 | 0.36 | 0.20 | 0.08 | 0.32 | 0.23 | X | X | X | X | X | X | 0.25 |
| X-4 |                                                            | 92.15  | 0.28 | 0.36 | 0.17 | 0.03 | 0.24 | 0.16 | X | X | X | X | X | X | 0.21 |
| X-5 |                                                            | 92.15  | 0.13 | 0.16 | 0.15 | 0.03 | 0.11 | 0.09 | X | X | X | X | X | X | 0.11 |
| X-1 | Tetrachloroethene<br>(Perchloroethylene)<br>CAS # 127-18-4 | 165.83 | 0.01 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.01 |
| X-2 |                                                            | 165.83 | 0.02 | 0.02 | 0.01 | 0.00 | 0.01 | 0.00 | X | X | X | X | X | X | 0.01 |
| X-3 |                                                            | 165.83 | 0.02 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | X | X | X | X | X | X | 0.01 |
| X-4 |                                                            | 165.83 | 0.02 | 0.02 | 0.01 | 0.00 | 0.01 | 0.00 | X | X | X | X | X | X | 0.01 |
| X-5 |                                                            | 165.83 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |

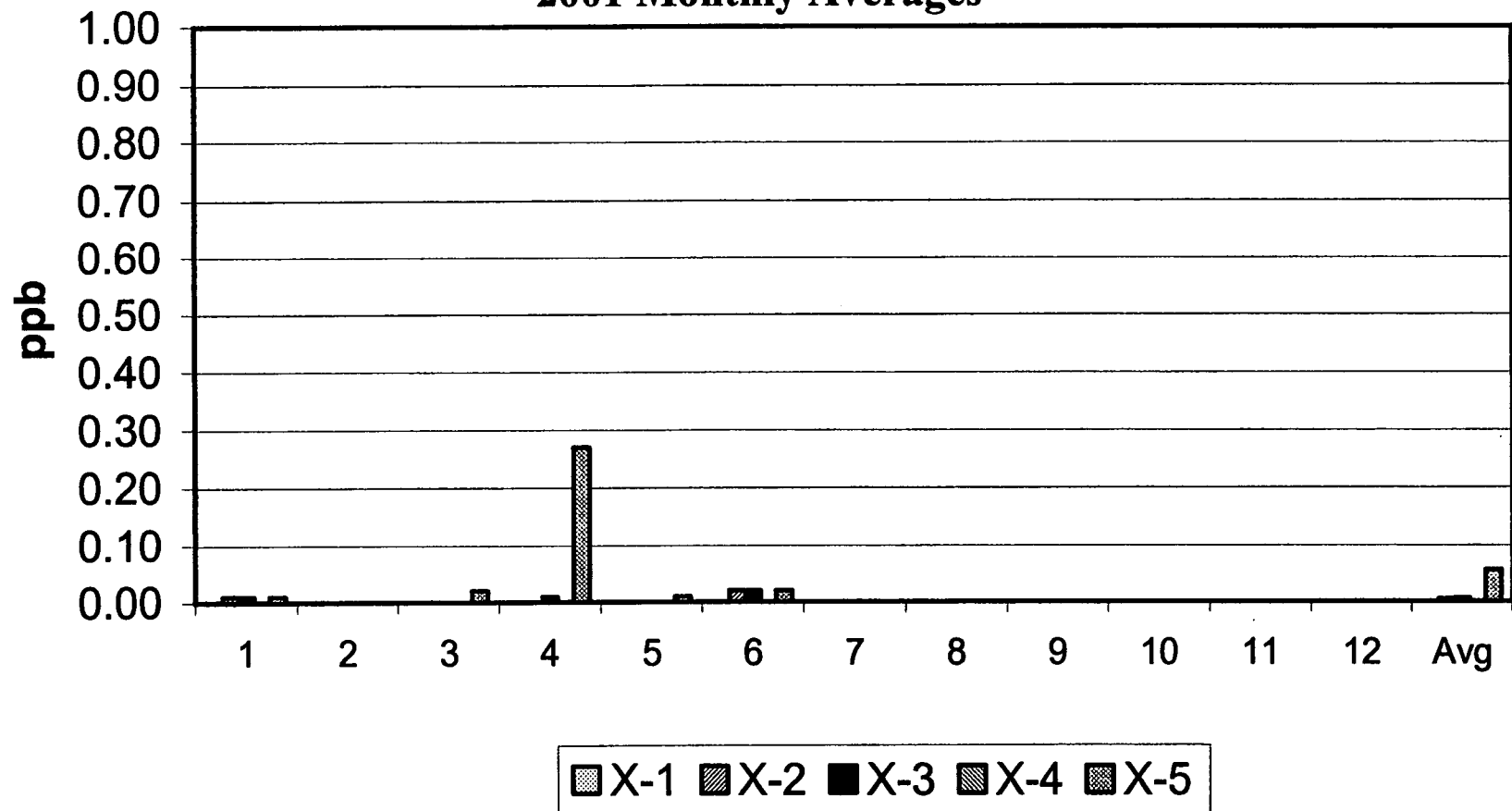
|     |                           |        |      |      |      |      |      |      |   |   |   |   |   |   |      |
|-----|---------------------------|--------|------|------|------|------|------|------|---|---|---|---|---|---|------|
| X-1 | Chlorobenzene             | 112.56 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-2 | CAS # 108-90-7            | 112.56 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-3 |                           | 112.56 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-4 |                           | 112.56 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-5 |                           | 112.56 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-1 | Ethyl benzene             | 106.17 | 0.05 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.01 |
| X-2 | (Phenylethane)            | 106.17 | 0.04 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.01 |
| X-3 | CAS # 100-41-4            | 106.17 | 0.03 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.01 |
| X-4 |                           | 106.17 | 0.04 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.01 |
| X-5 |                           | 106.17 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-1 | m- + p-Xylene             | 106.17 | 0.04 | 0.03 | 0.02 | 0.00 | 0.01 | 0.00 | X | X | X | X | X | X | 0.02 |
| X-2 | (1,3- + 1,4-              | 106.17 | 0.05 | 0.04 | 0.03 | 0.00 | 0.02 | 0.01 | X | X | X | X | X | X | 0.03 |
| X-3 | Dimethylbenzene)          | 106.17 | 0.04 | 0.03 | 0.02 | 0.00 | 0.02 | 0.01 | X | X | X | X | X | X | 0.02 |
| X-4 | CAS # n/a                 | 106.17 | 0.03 | 0.04 | 0.01 | 0.00 | 0.02 | 0.00 | X | X | X | X | X | X | 0.02 |
| X-5 |                           | 106.17 | 0.02 | 0.02 | 0.01 | 0.00 | 0.01 | 0.00 | X | X | X | X | X | X | 0.01 |
| X-1 | Styrene                   | 104.16 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-2 | CAS # 100-42-5            | 104.16 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-3 |                           | 104.16 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-4 |                           | 104.16 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-5 |                           | 104.16 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-1 | 1,1,2,2-Tetrachloroethane | 167.85 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-2 | CAS # 79-34-5             | 167.85 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-3 |                           | 167.85 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-4 |                           | 167.85 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-5 |                           | 167.85 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.00 |
| X-1 | o-Xylene                  | 106.17 | 0.03 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.01 |
| X-2 | (1,2-Dimethylbenzene)     | 106.17 | 0.03 | 0.02 | 0.02 | 0.00 | 0.01 | 0.00 | X | X | X | X | X | X | 0.01 |
| X-3 | CAS # 95-47-6             | 106.17 | 0.03 | 0.02 | 0.01 | 0.00 | 0.01 | 0.00 | X | X | X | X | X | X | 0.01 |
| X-4 |                           | 106.17 | 0.02 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.01 |
| X-5 |                           | 106.17 | 0.02 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | X | X | X | X | X | X | 0.01 |



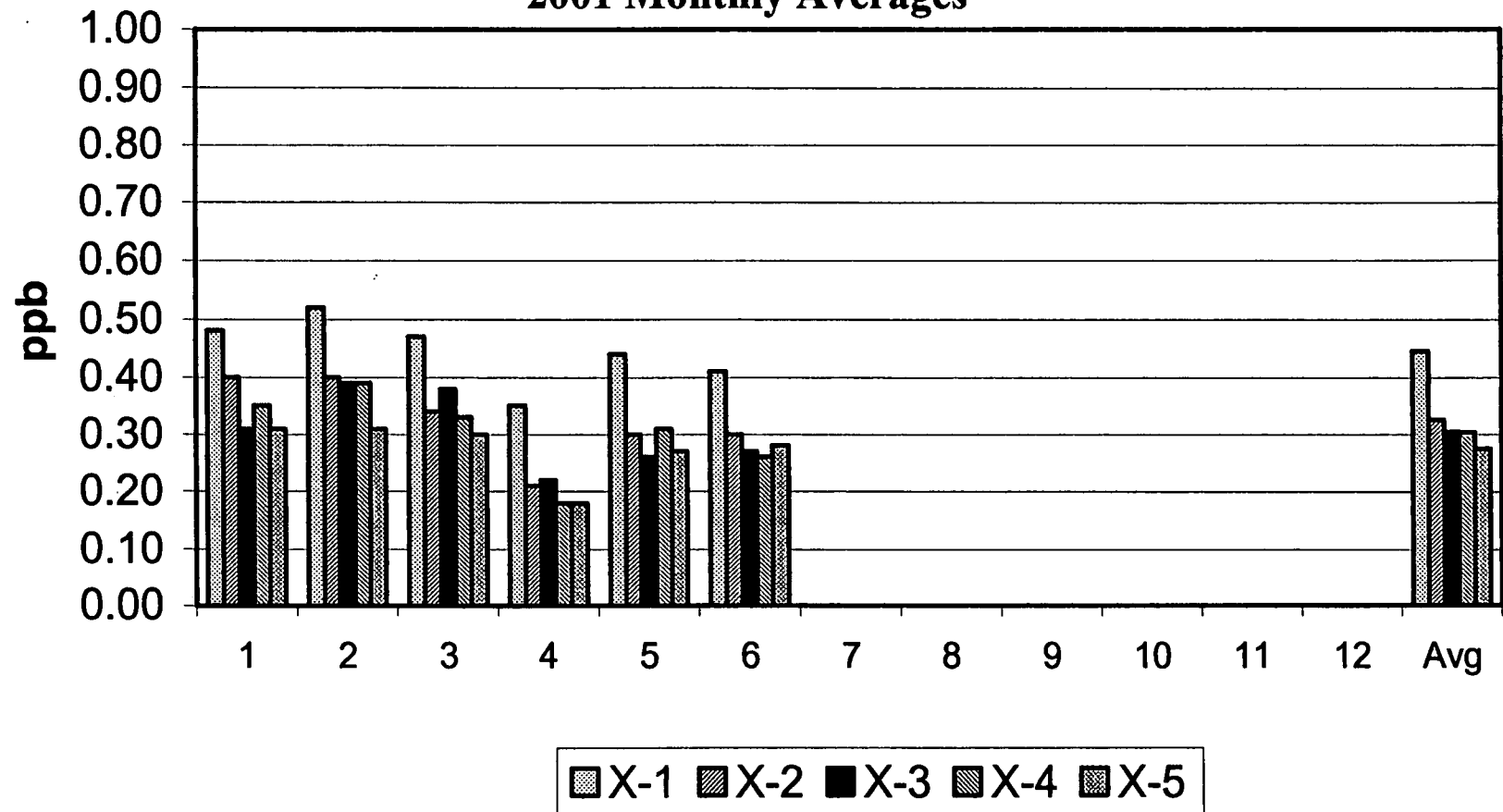
**Freon 134a**  
**2001 Monthly Averages**



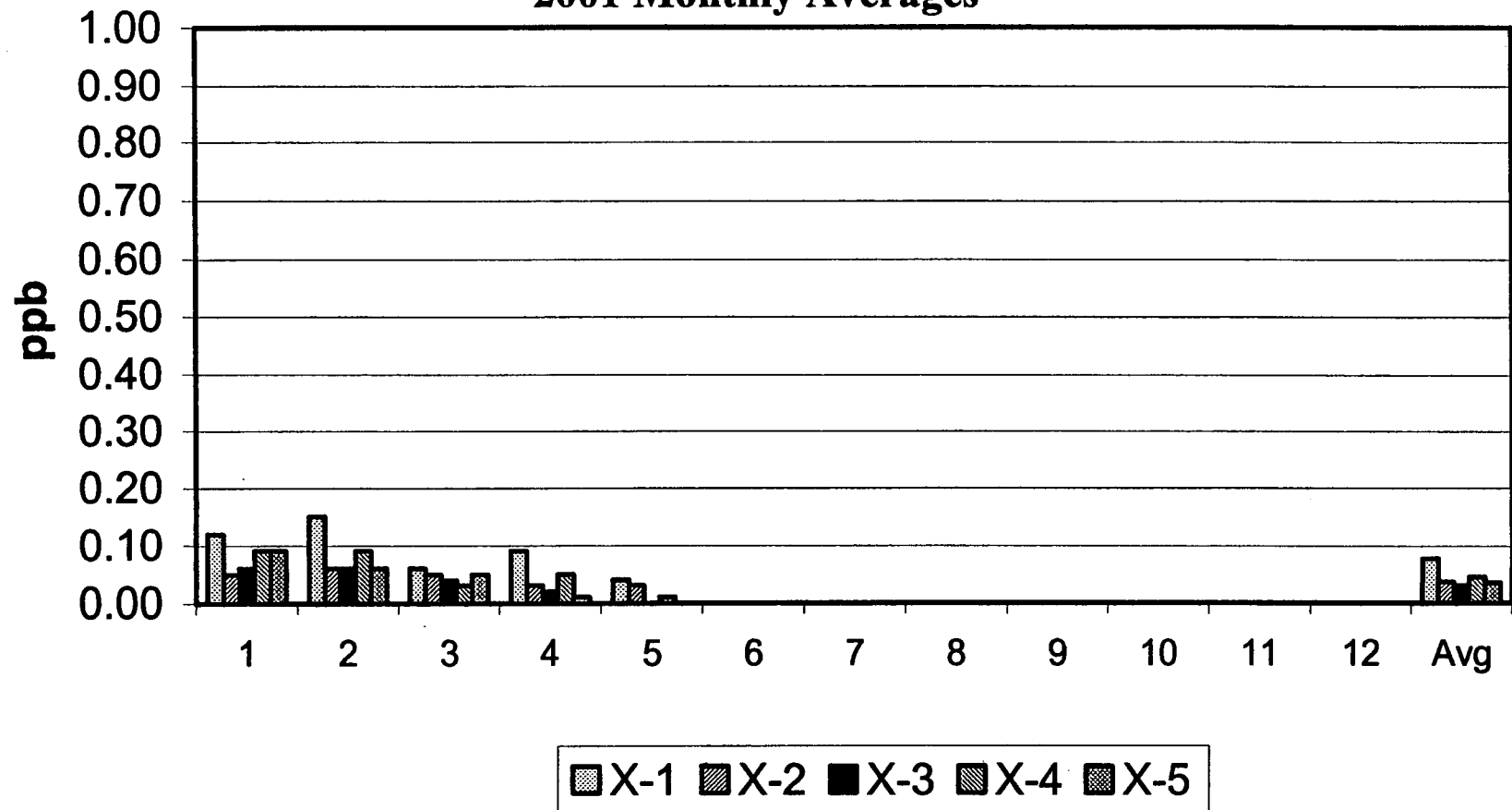
**Freon 22**  
**2001 Monthly Averages**

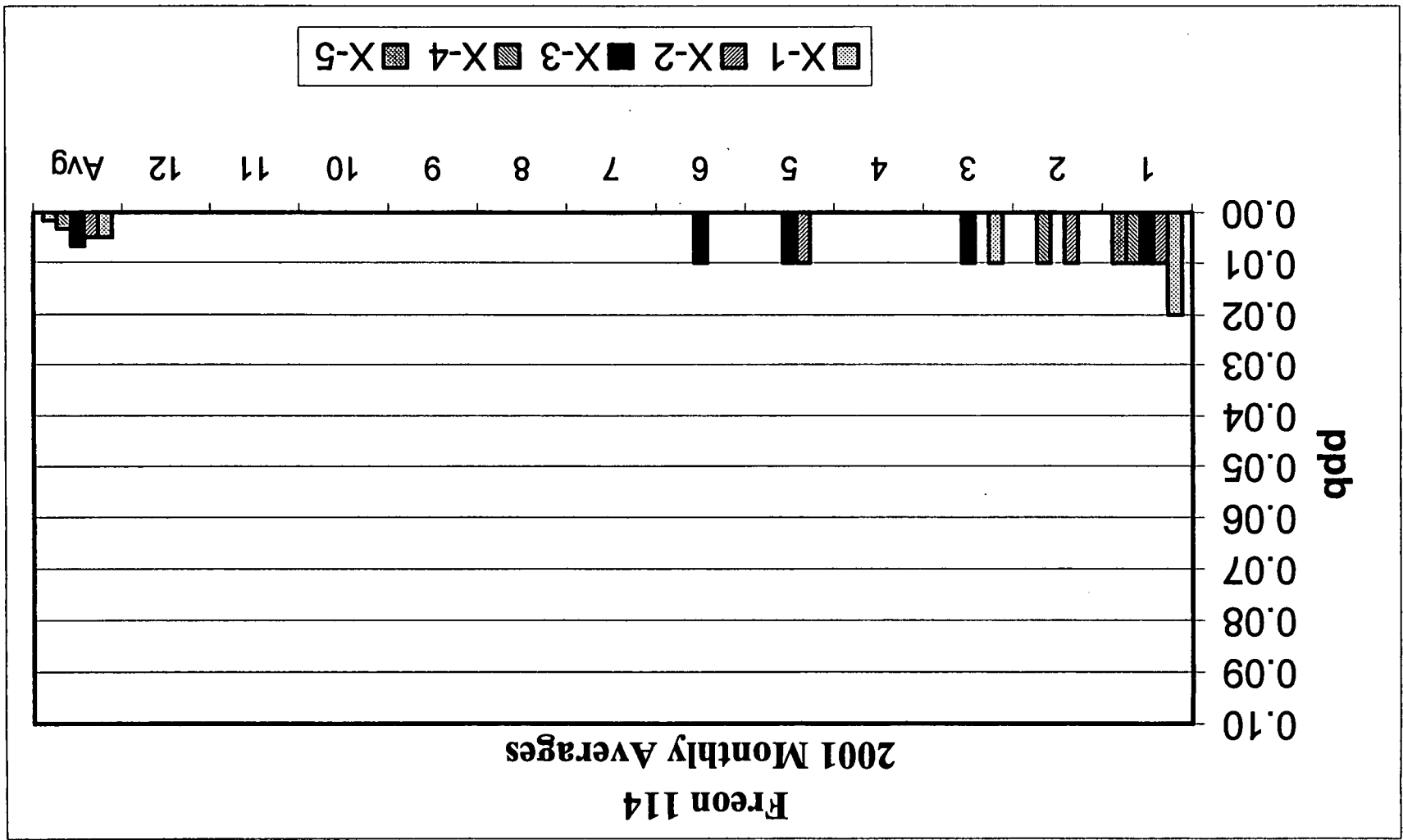


**Freon 12**  
**2001 Monthly Averages**

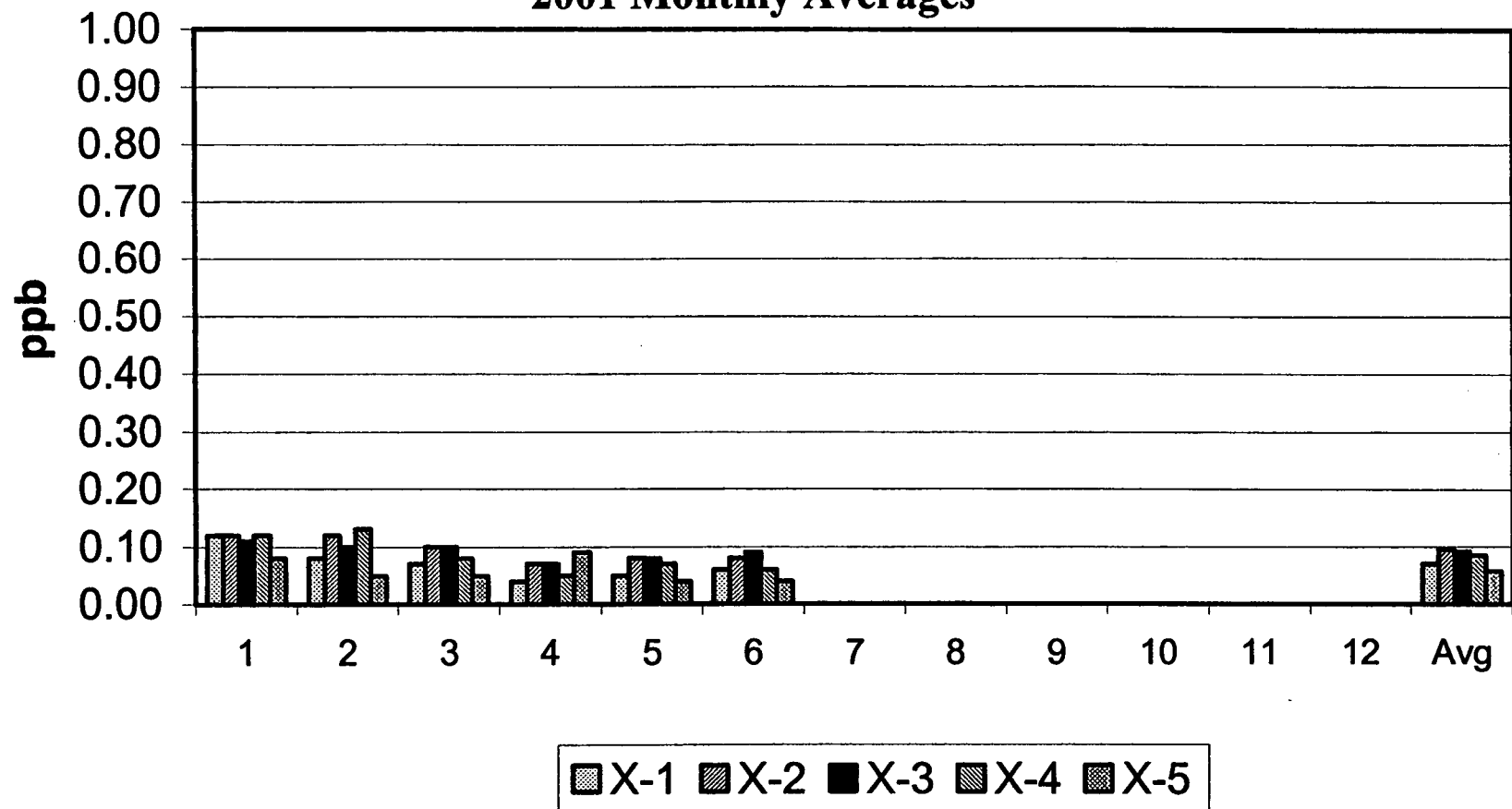


# Chloromethane 2001 Monthly Averages

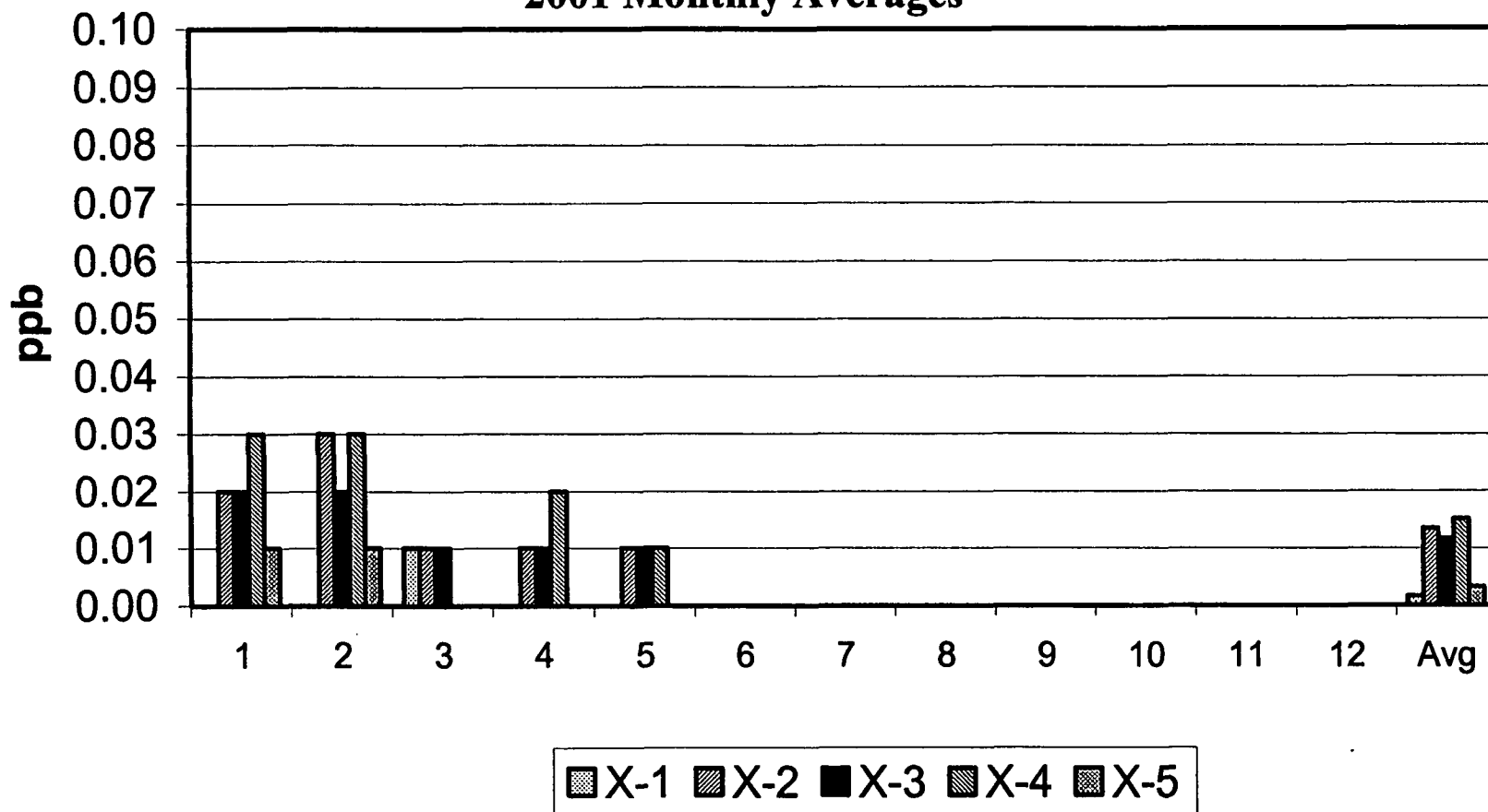




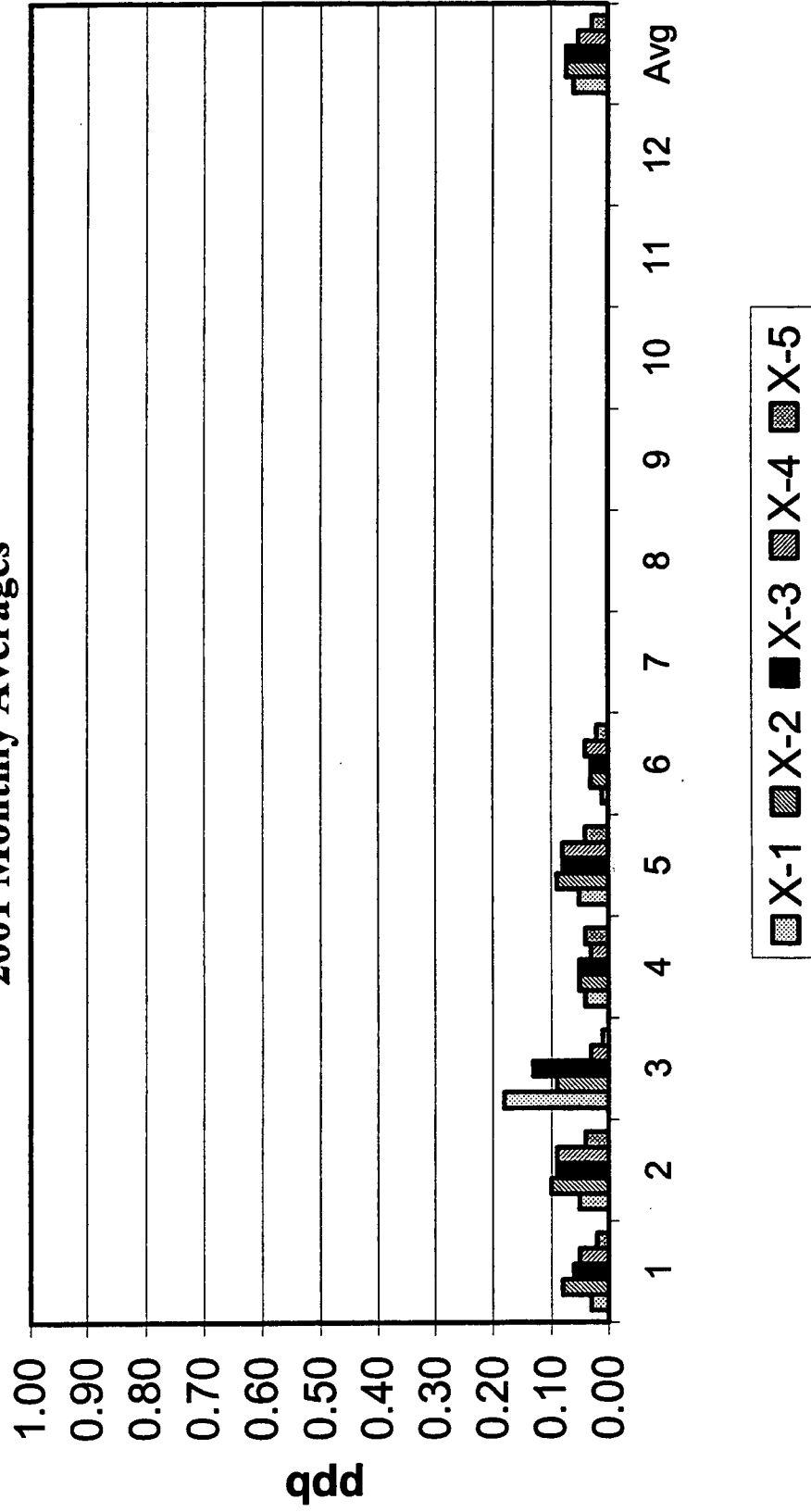
**Freon 11**  
**2001 Monthly Averages**



**Vinylidene Chloride  
2001 Monthly Averages**

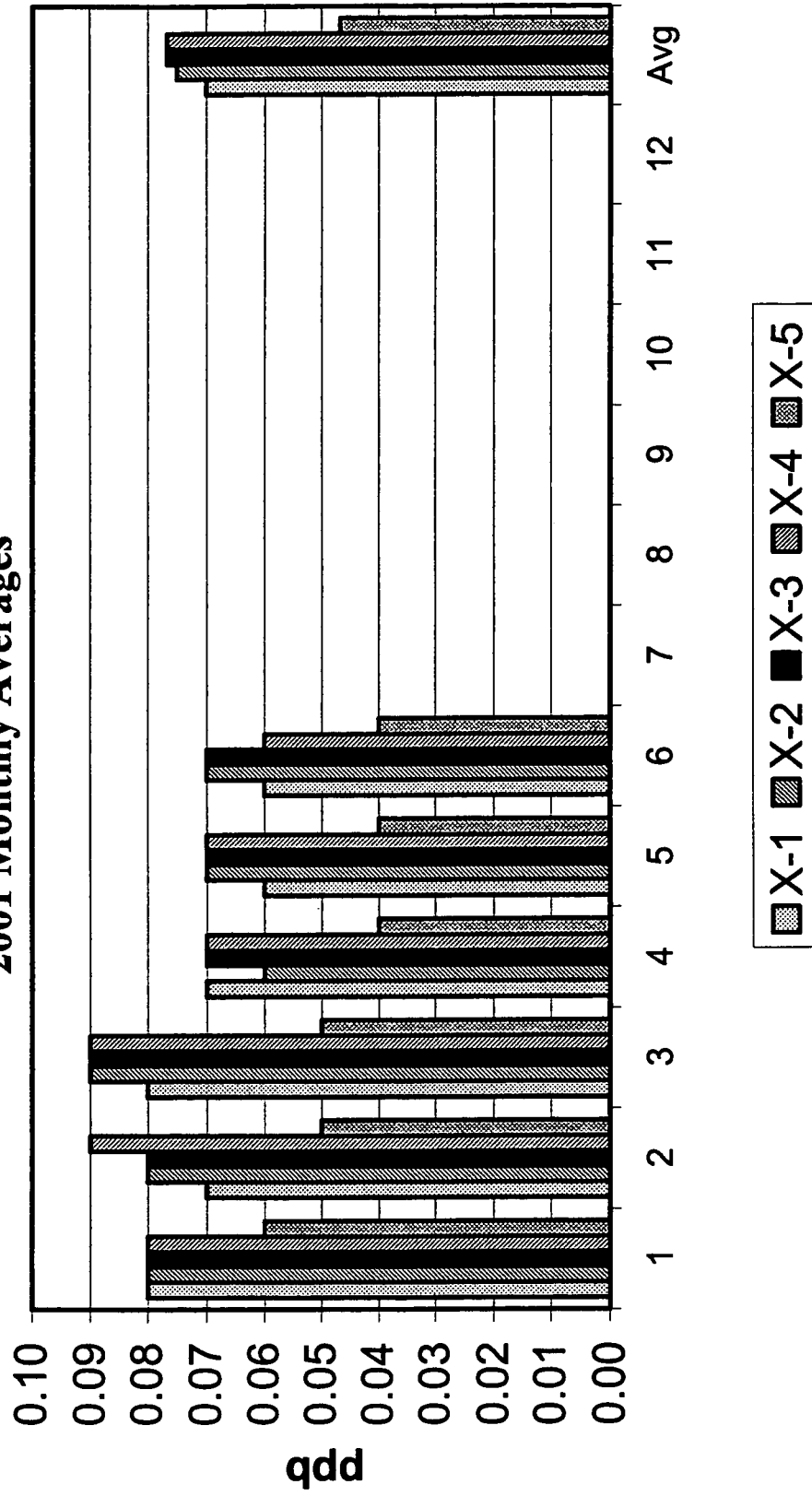


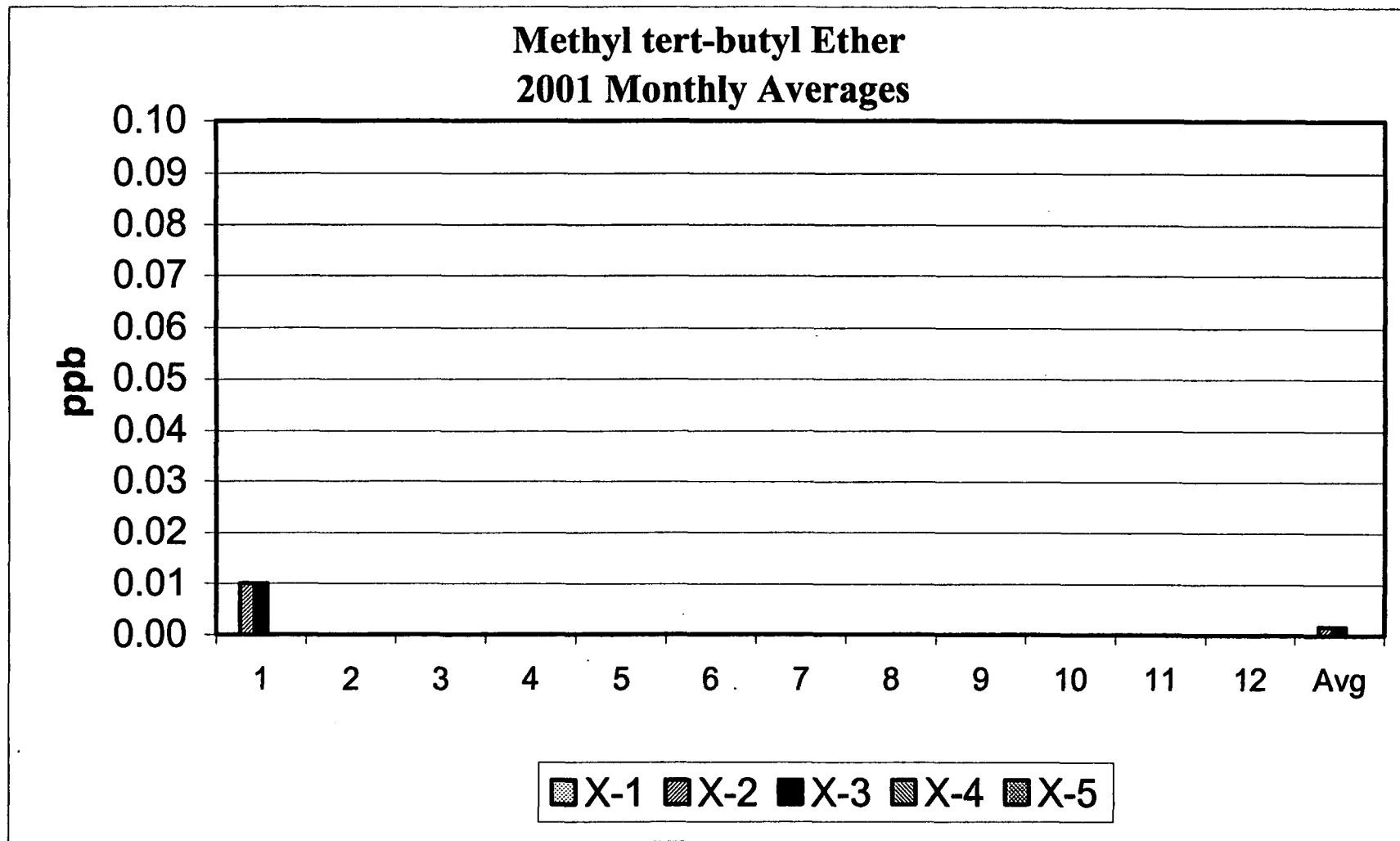
# Dichloromethane 2001 Monthly Averages

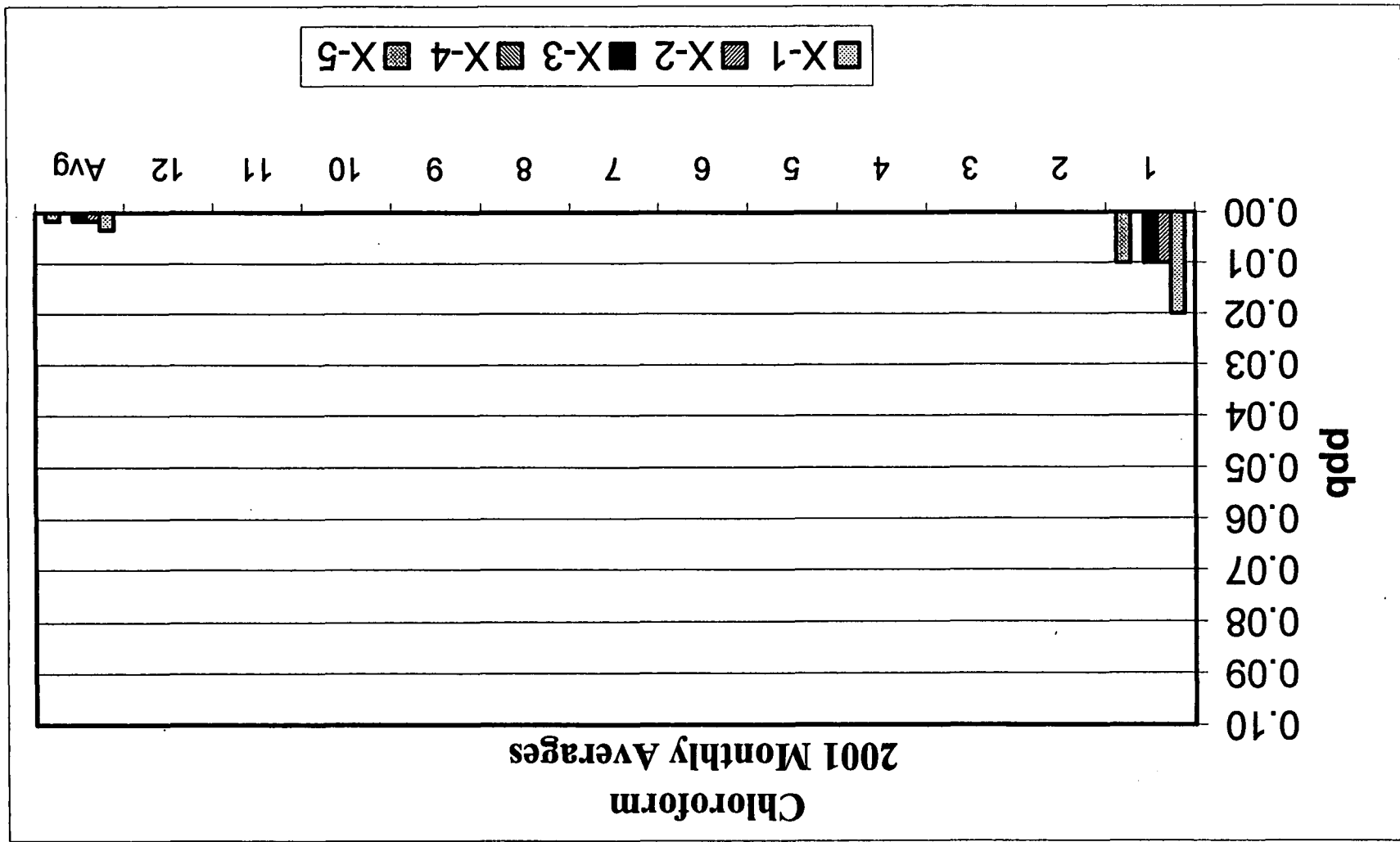




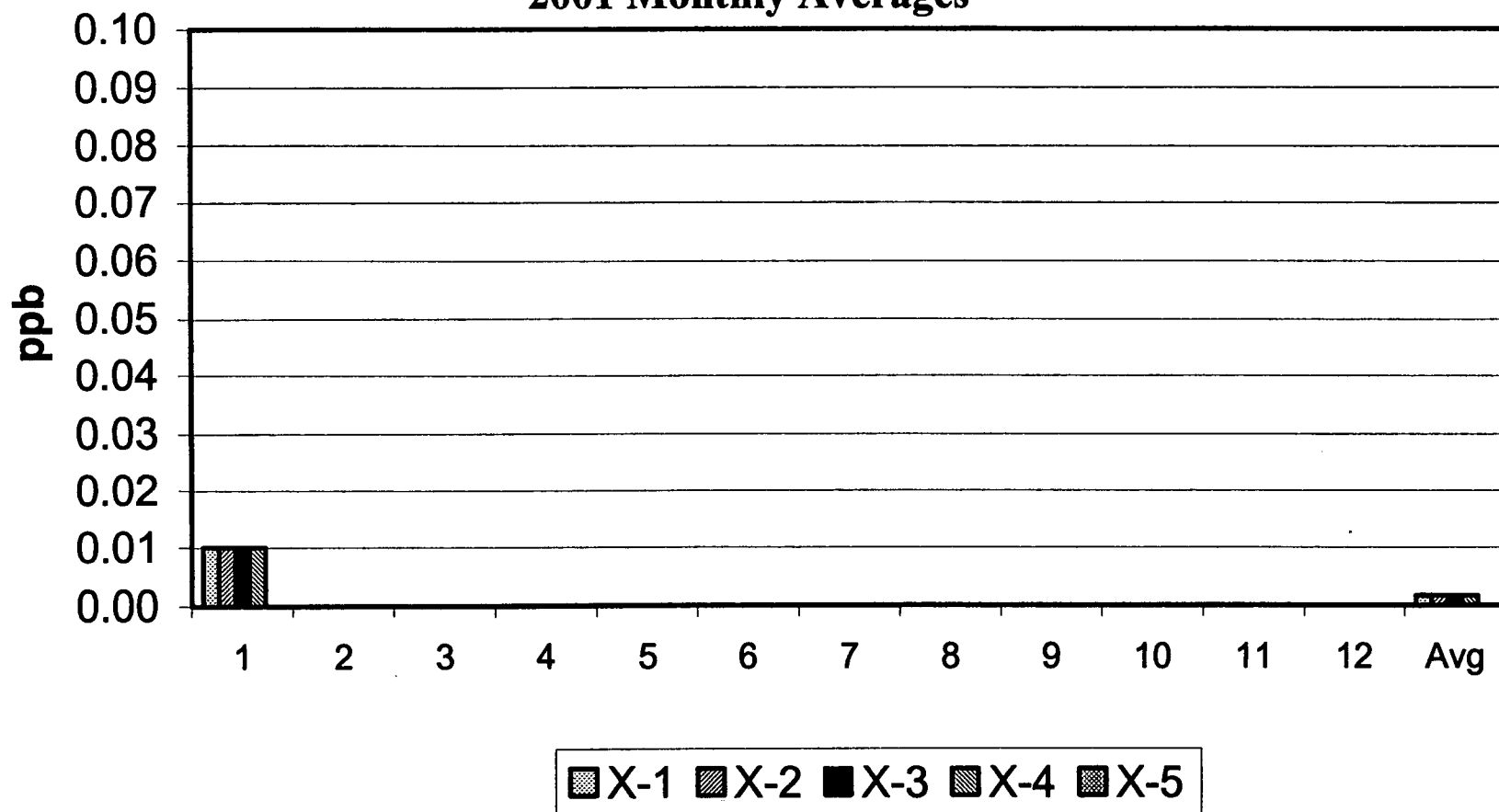
# Freon 113 2001 Monthly Averages



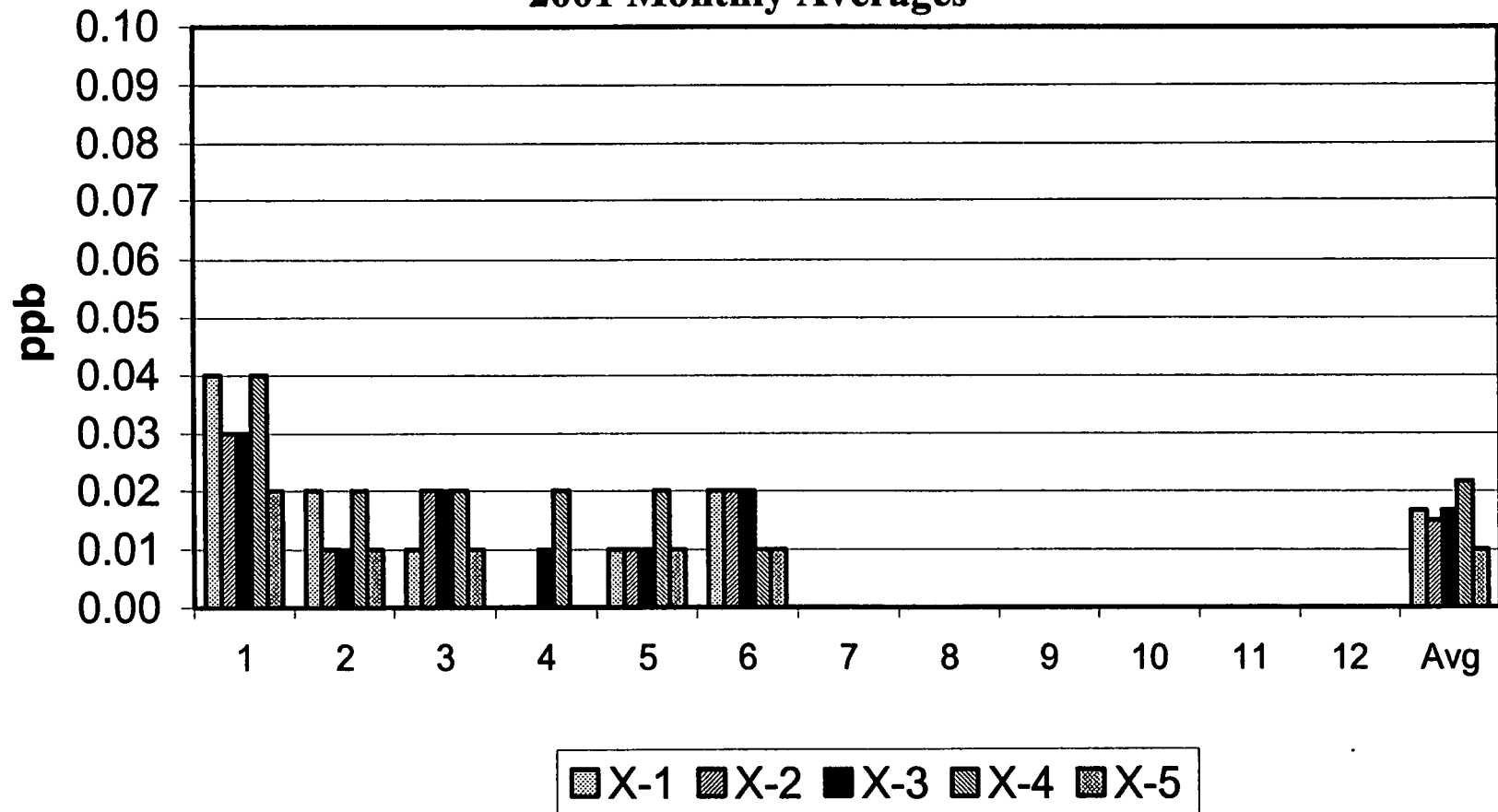




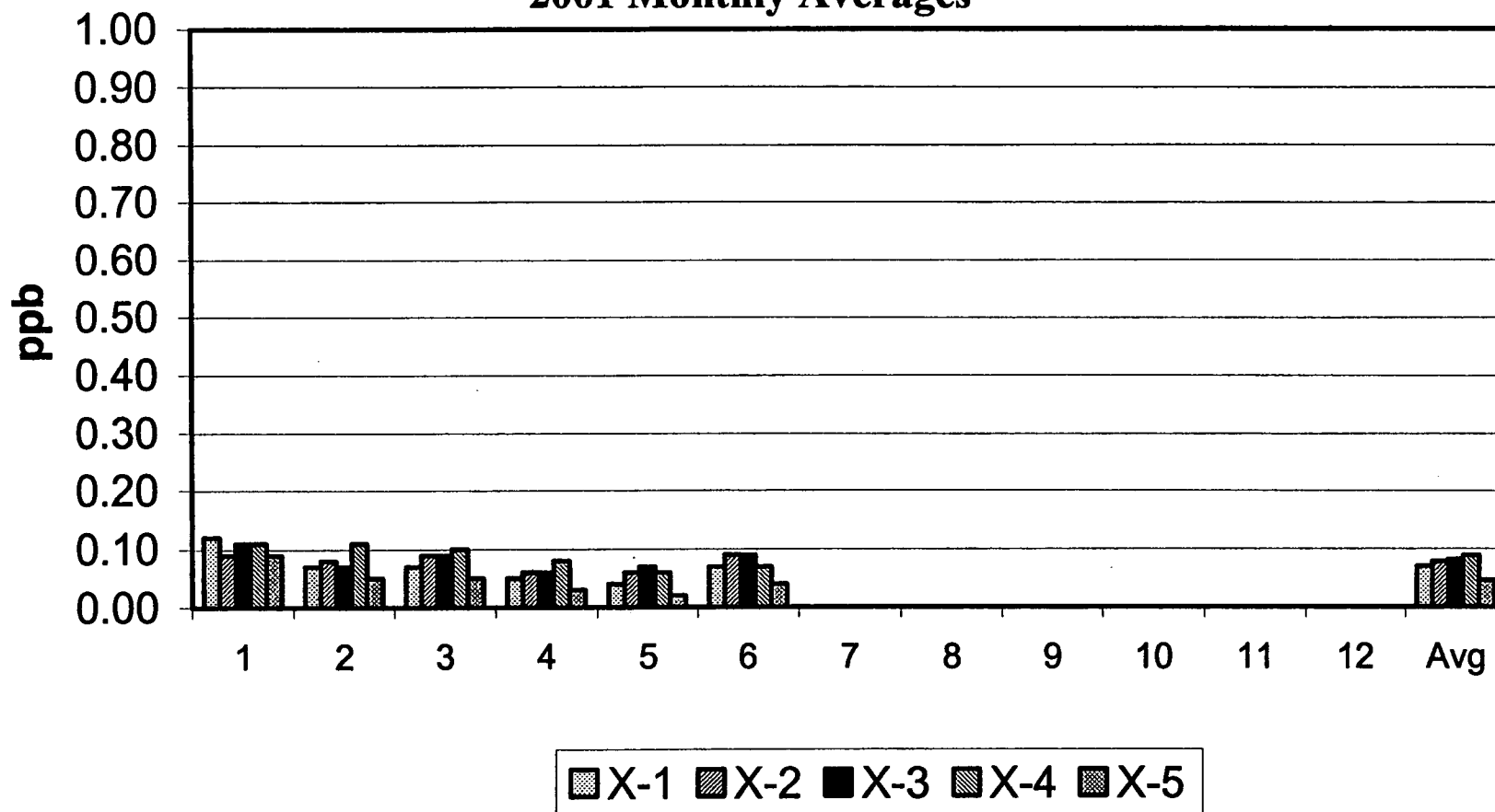
**1,2-Dichloroethane  
2001 Monthly Averages**



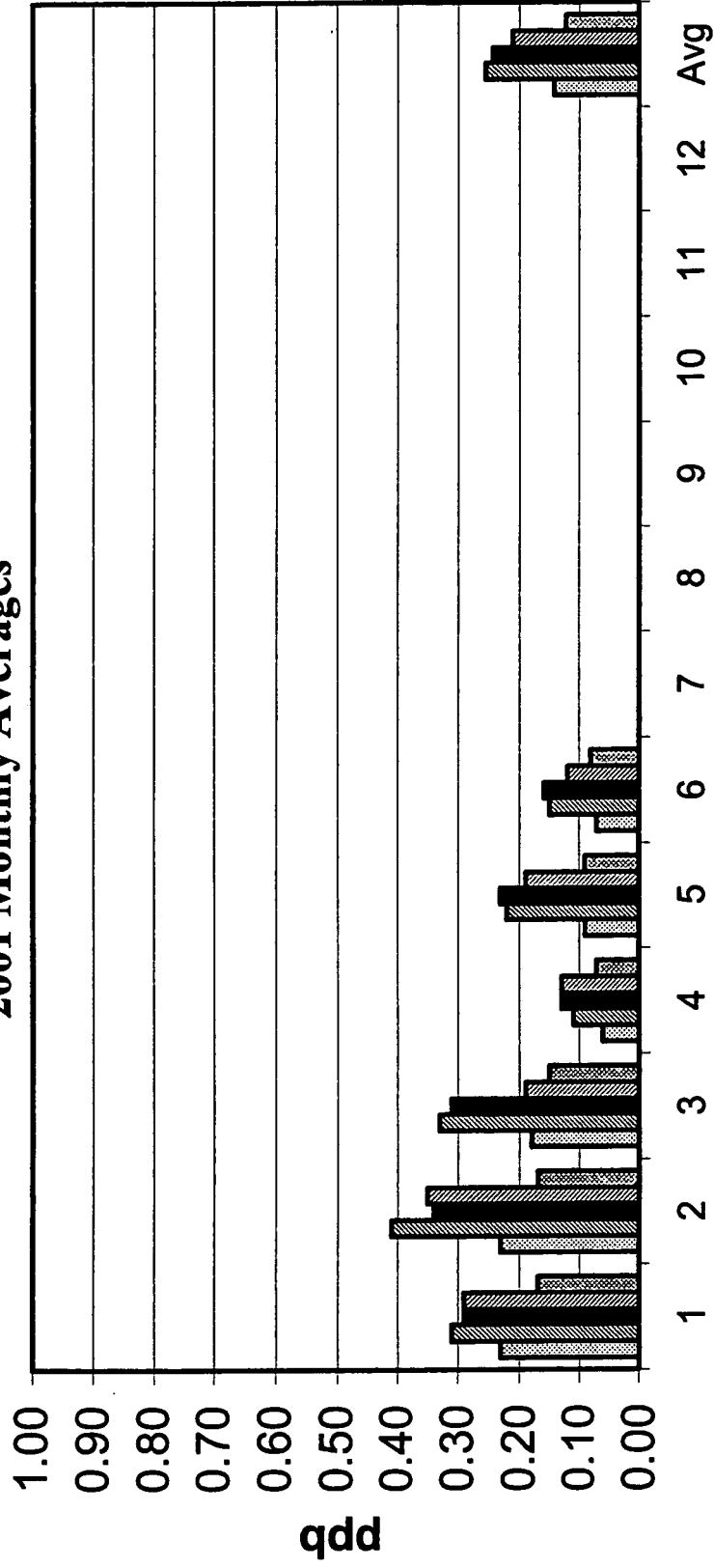
**1,1,1-Trichloroethane  
2001 Monthly Averages**



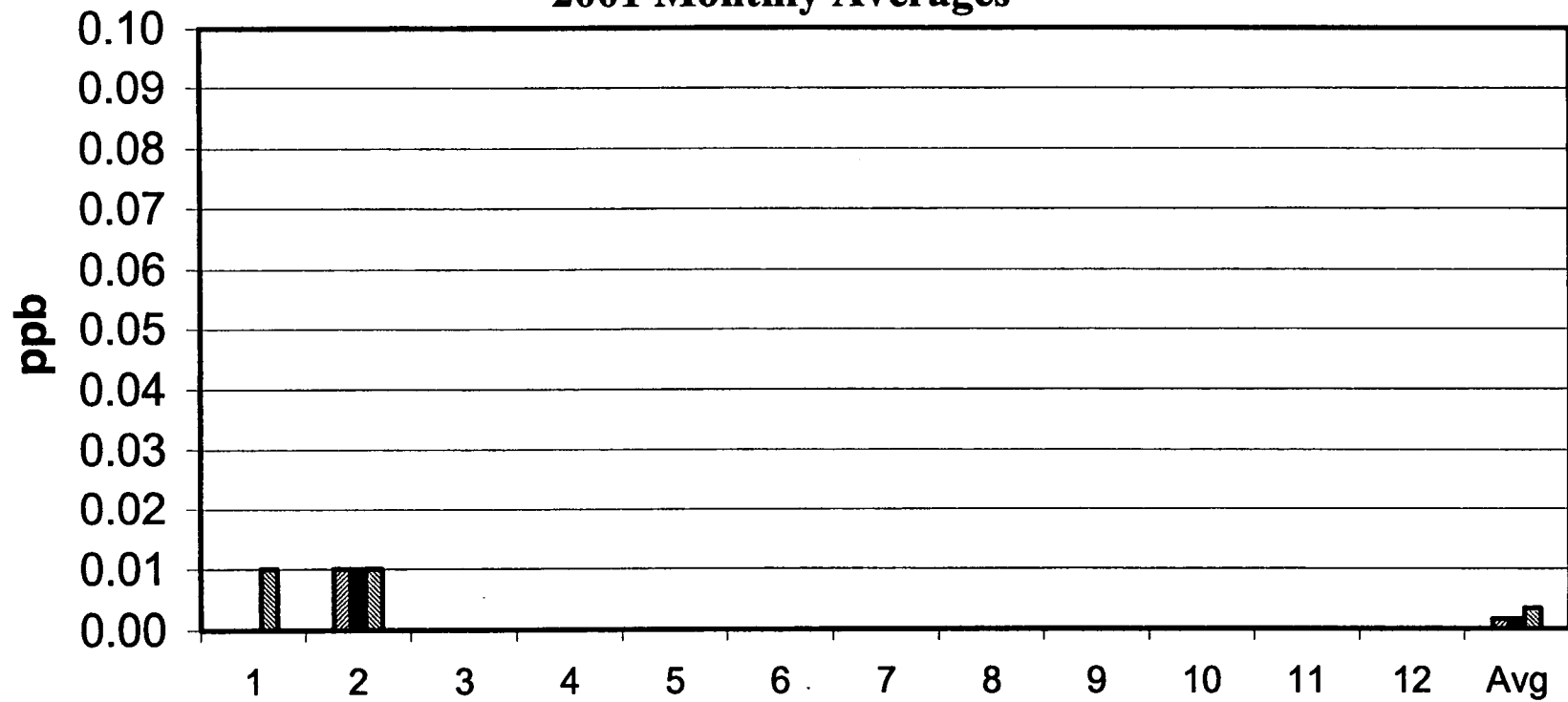
# Carbon Tetrachloride 2001 Monthly Averages



# **Benzene** **2001 Monthly Averages**



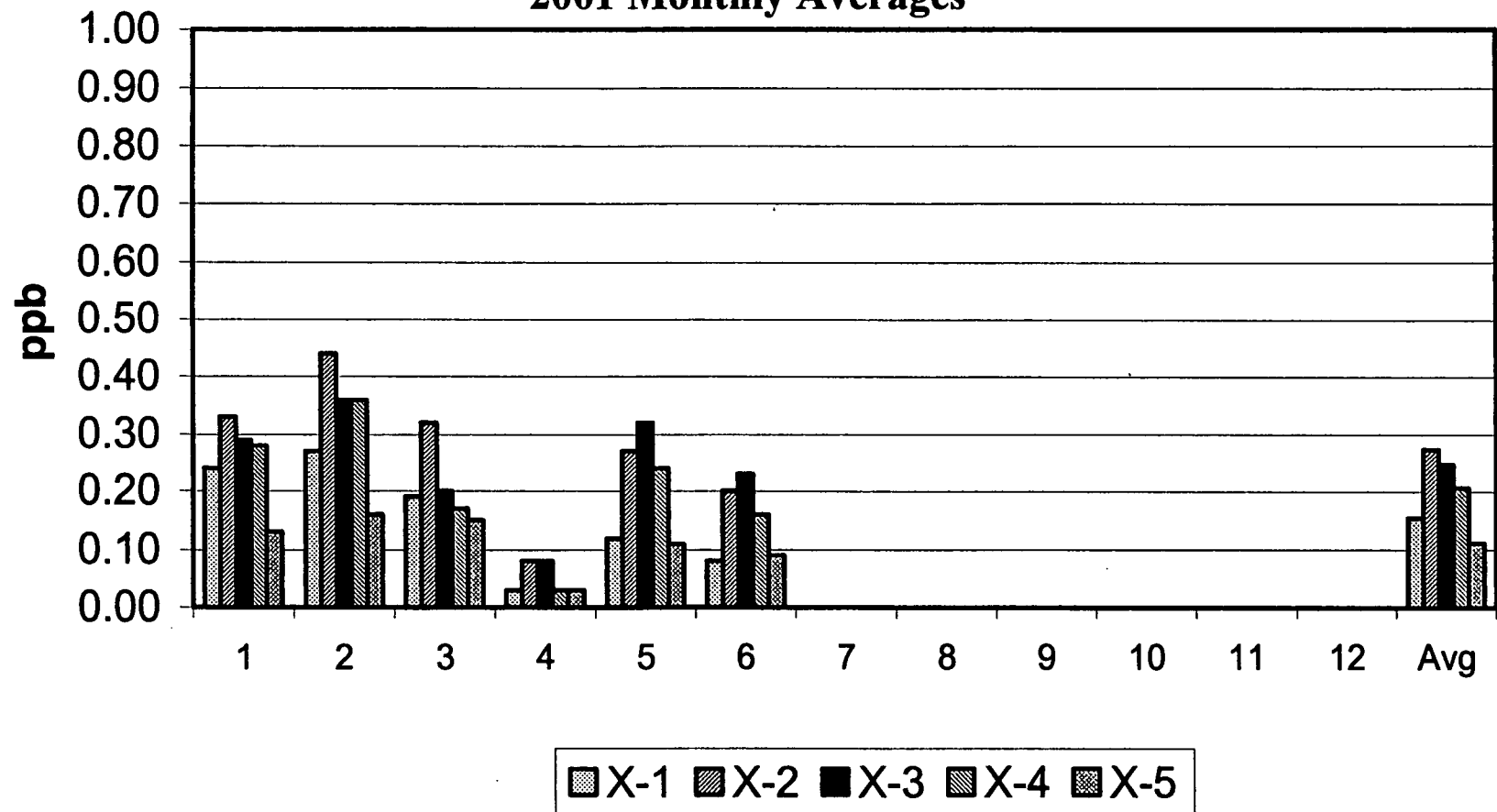
**Trichloroethene**  
**2001 Monthly Averages**

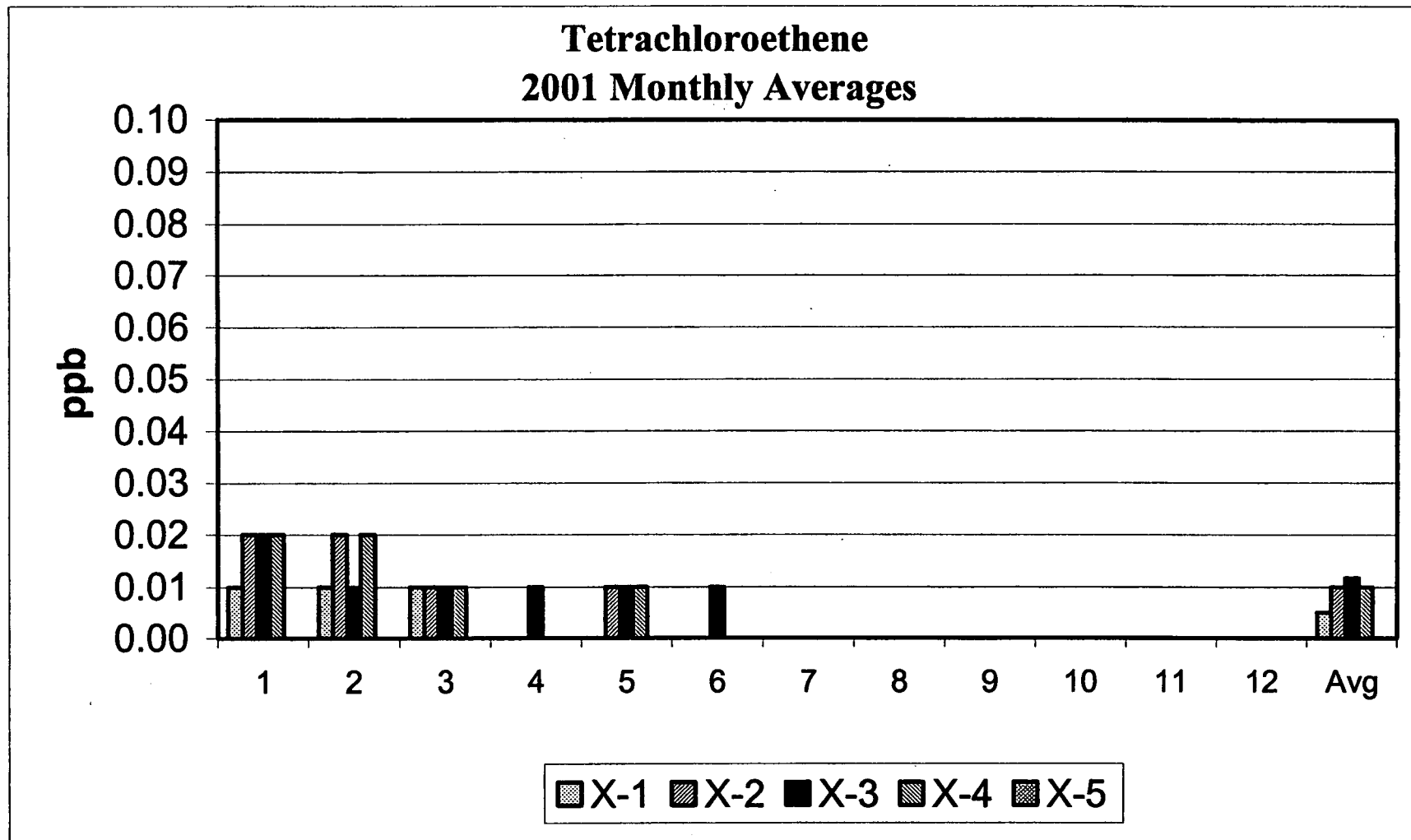


■ X-1 ■ X-2 ■ X-3 ■ X-4 ■ X-5

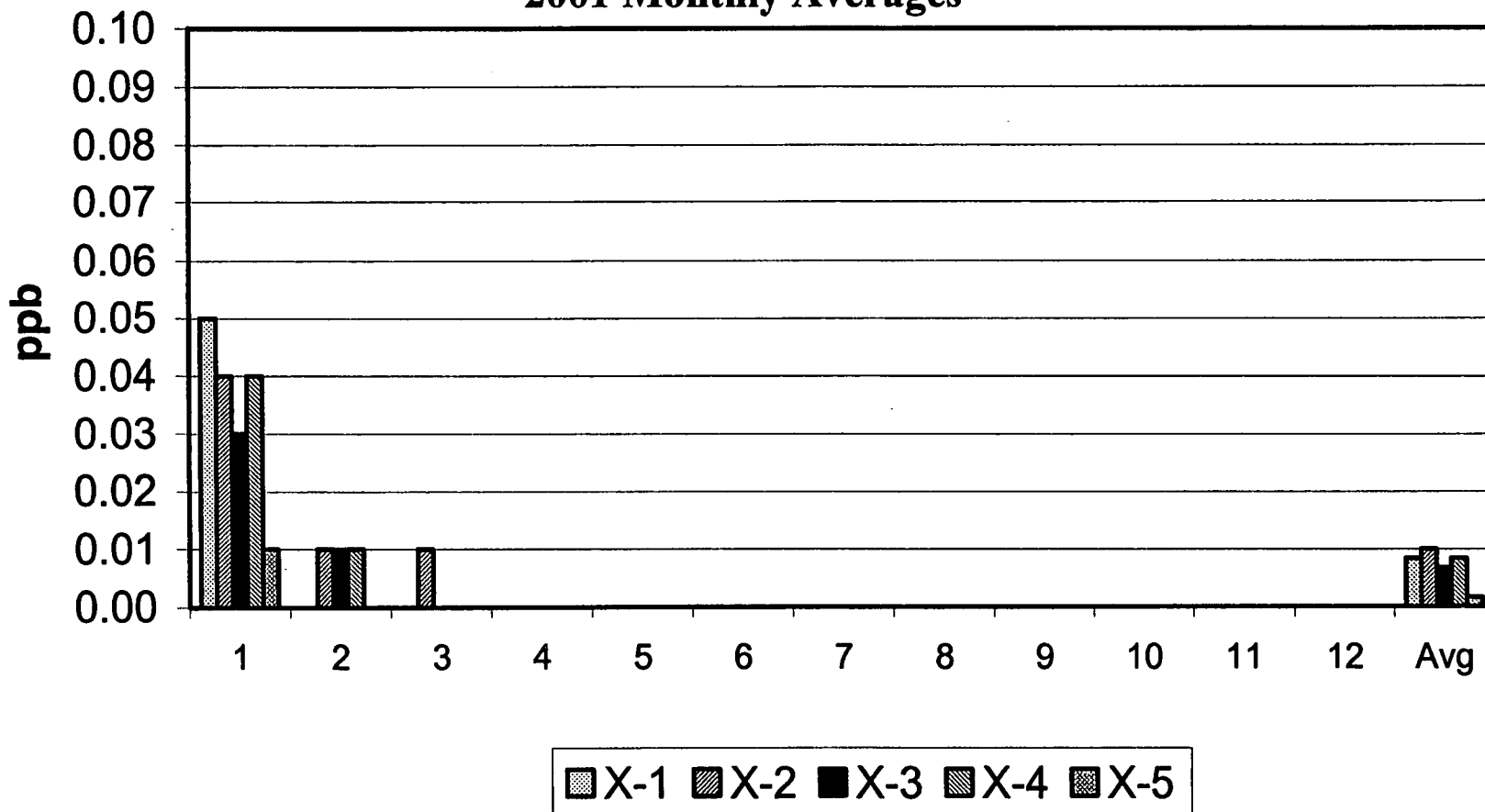


**Toluene**  
**2001 Monthly Averages**

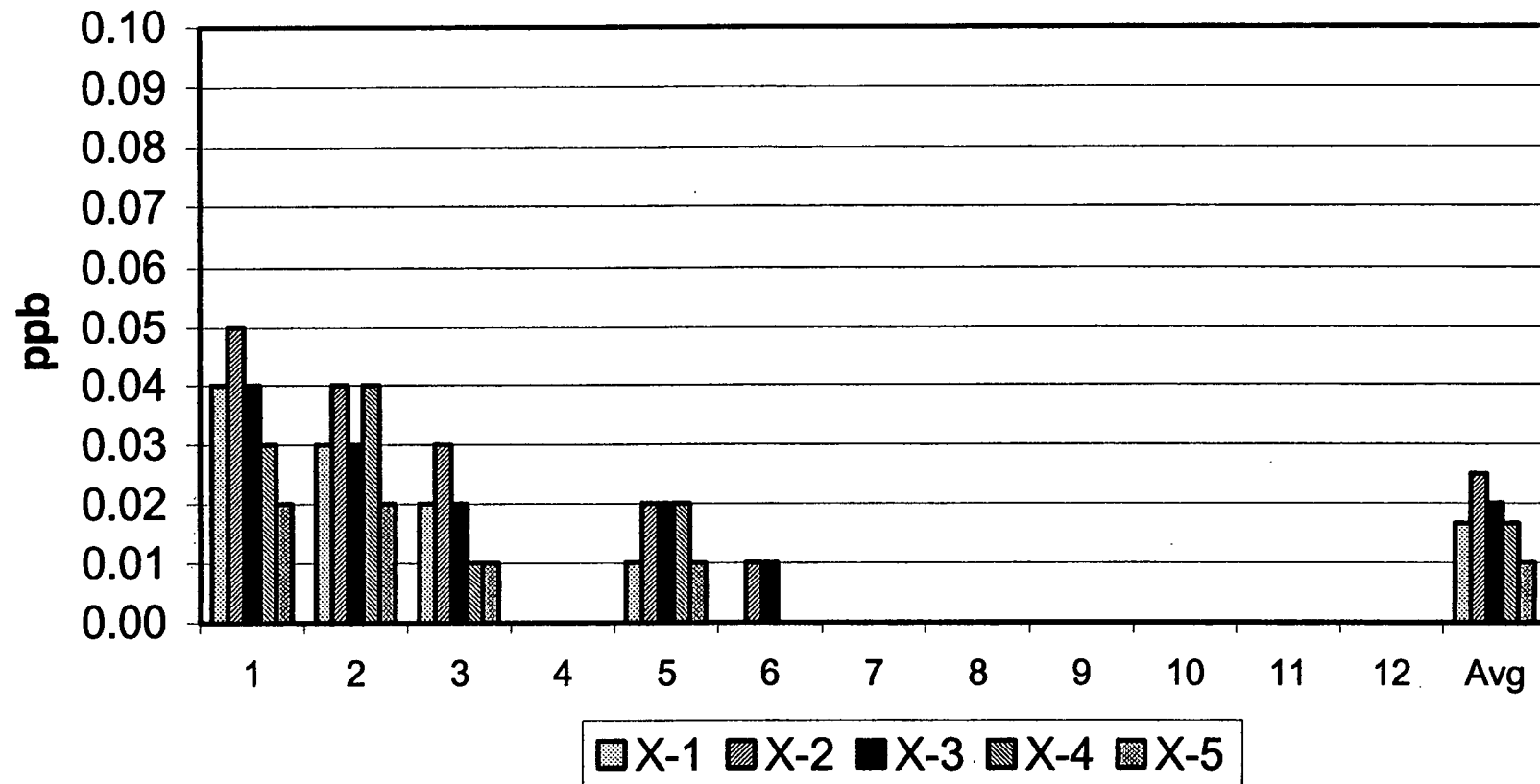




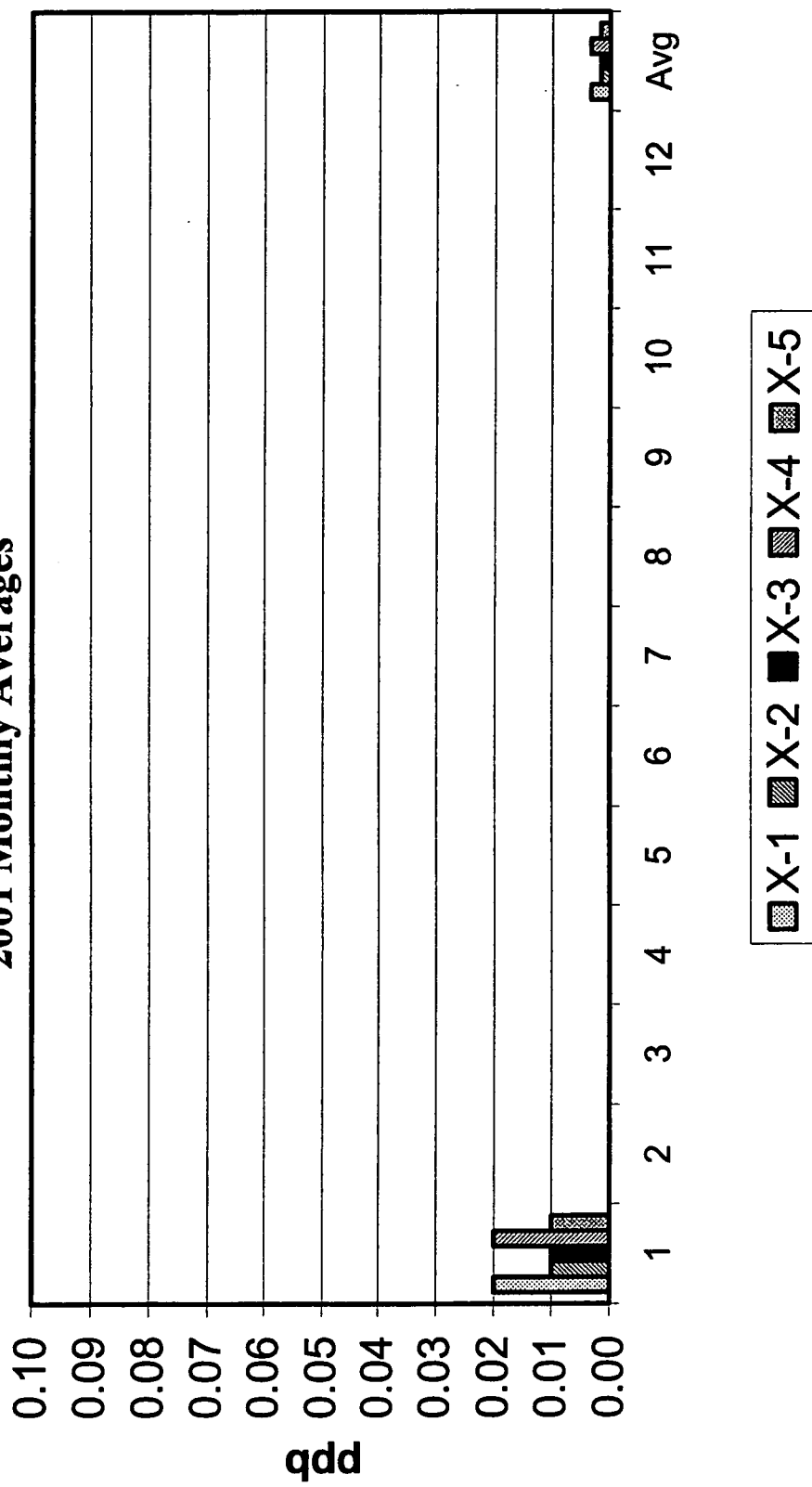
**Ethylbenzene  
2001 Monthly Averages**



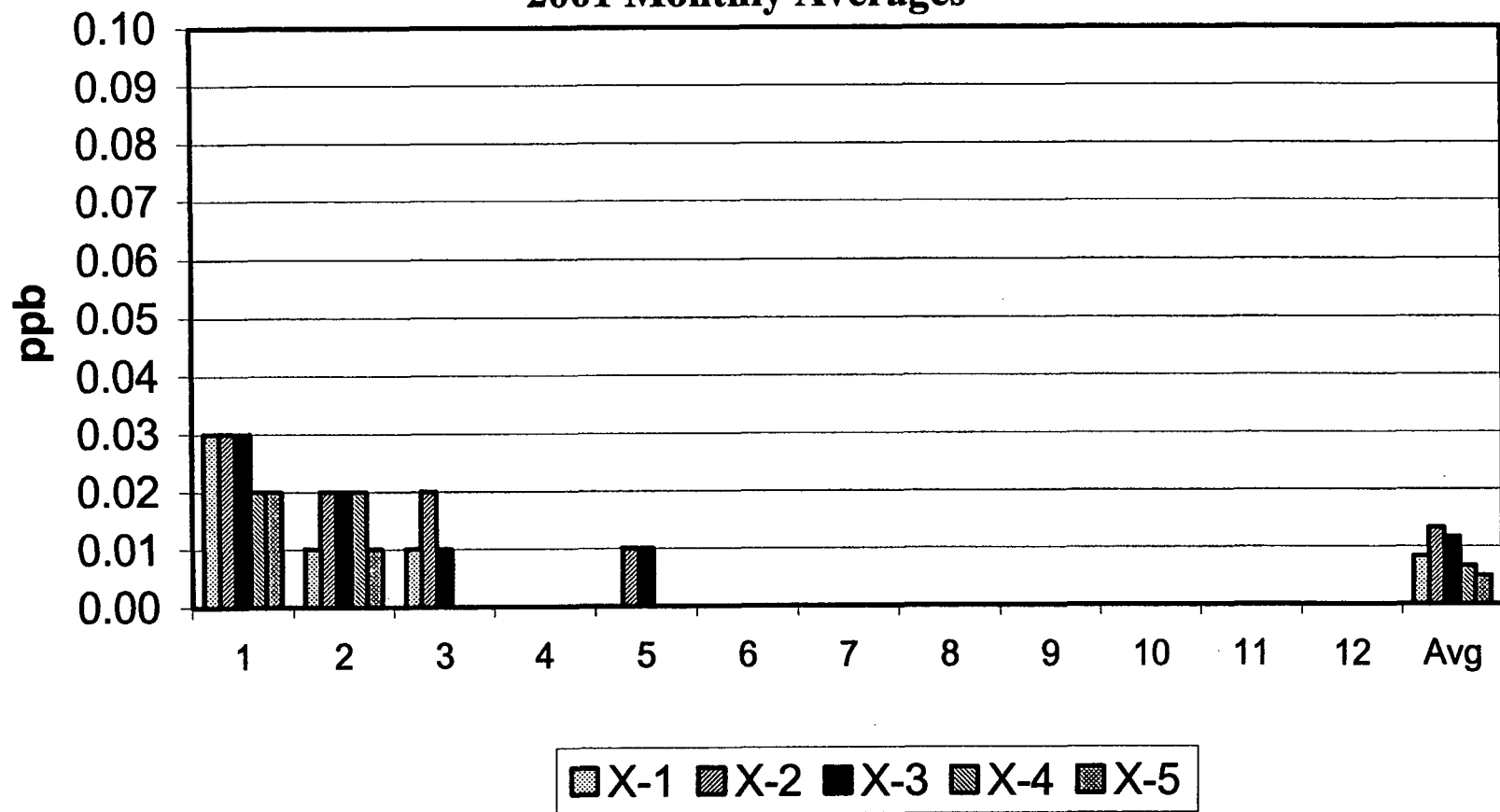
**m and p-Xylene  
2001 Monthly Averages**



# Styrene 2001 Monthly Averages



**o-Xylene**  
**2001 Monthly Averages**



# **APPENDIX G**

## **OZONE DATA**

# AIR MONITORING AT RFETS

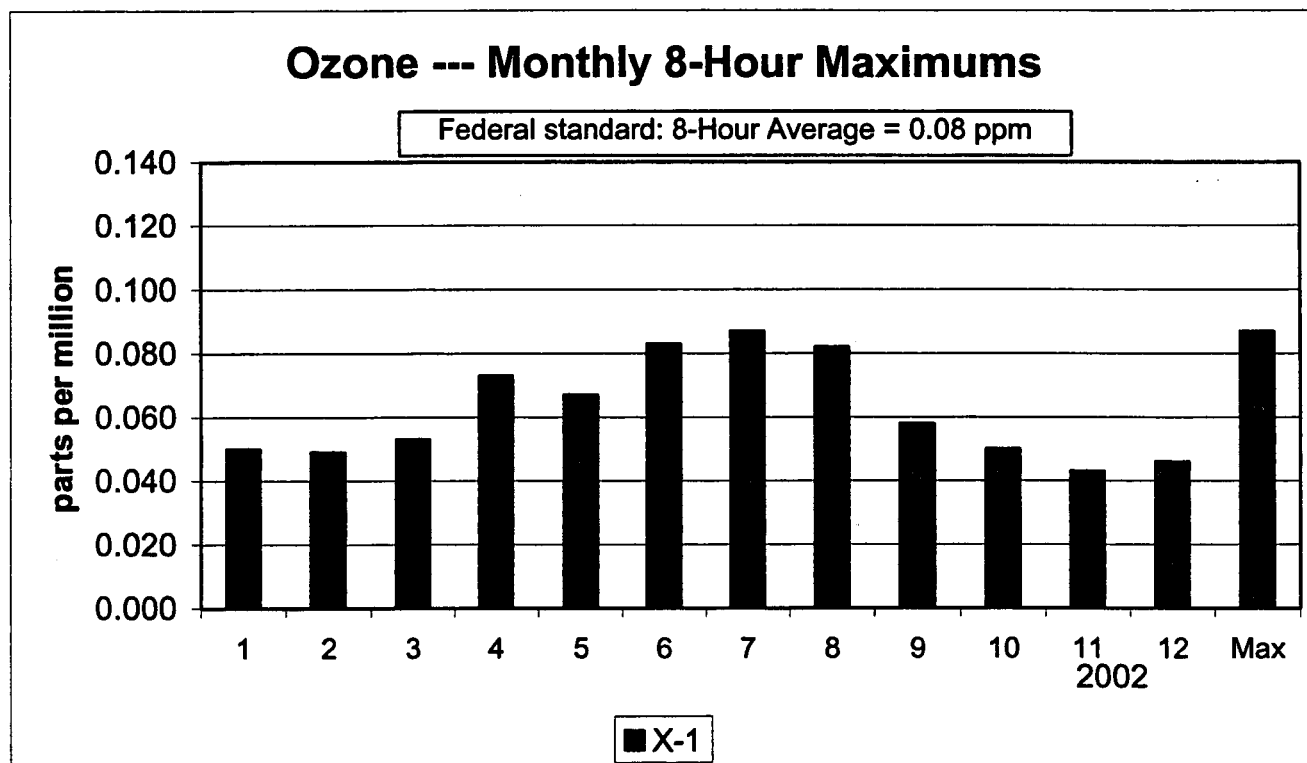
Ozone

2001

Monthly 8-Hour Maximum Data

(PPM)

|      | 2001  | Month |       |       |       |       |       |       |       |       |       |       | 2001  |
|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Site | 1     | 2     | 3     | 4     | 5     | 6     | 7     | 8     | 9     | 10    | 11    | 12    | Max   |
| X-1  | 0.050 | 0.049 | 0.053 | 0.073 | 0.067 | 0.083 | 0.087 | 0.082 | 0.058 | 0.050 | 0.043 | 0.046 | 0.087 |





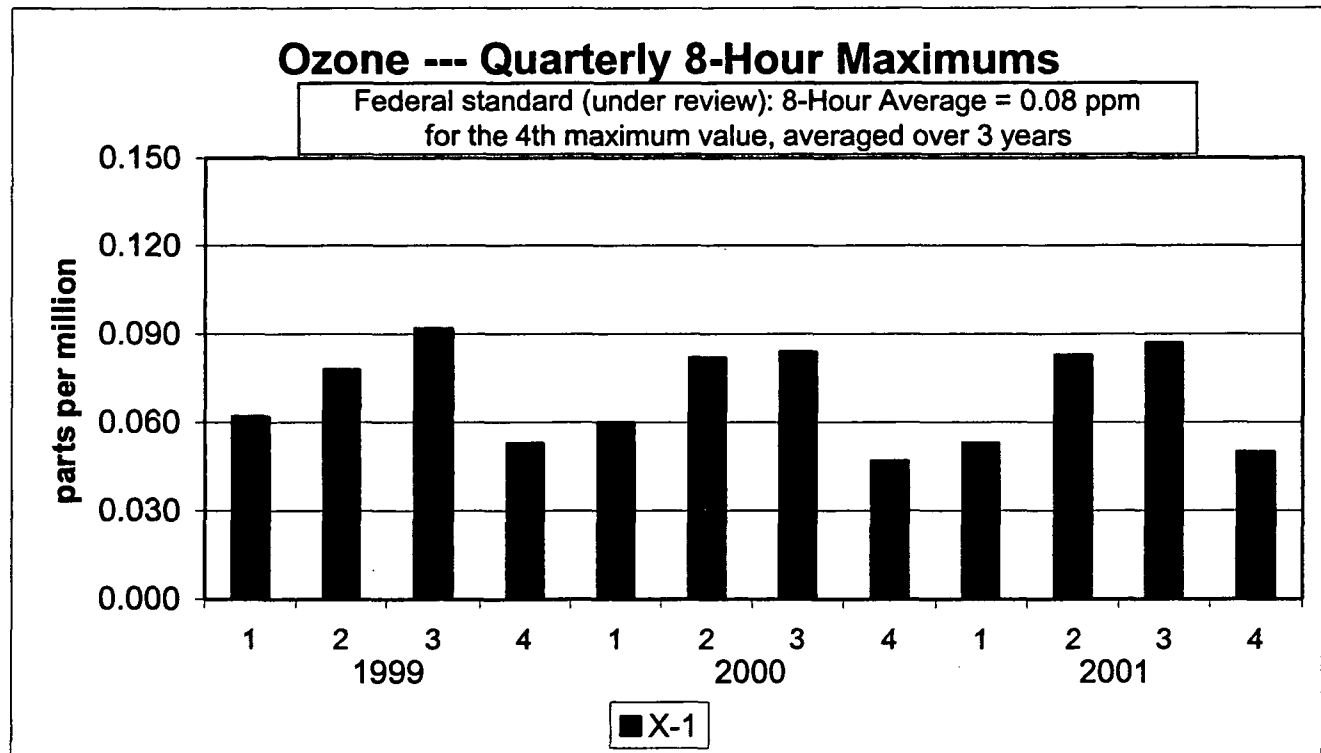
# AIR MONITORING AT RFETS

## Ozone

2001

### Quarterly 8-Hour Maximum Data (3-years) (ppm)

|      | 1999  |       |       |       | 2000  |       |       |       | 2001 |      |      |      |
|------|-------|-------|-------|-------|-------|-------|-------|-------|------|------|------|------|
| Site | 1     | 2     | 3     | 4     | 1     | 2     | 3     | 4     | 1    | 2    | 3    | 4    |
| X-1  | 0.062 | 0.078 | 0.092 | 0.053 | 0.060 | 0.082 | 0.084 | 0.047 | .053 | .083 | .087 | .050 |



# AIR MONITORING AT RFETS

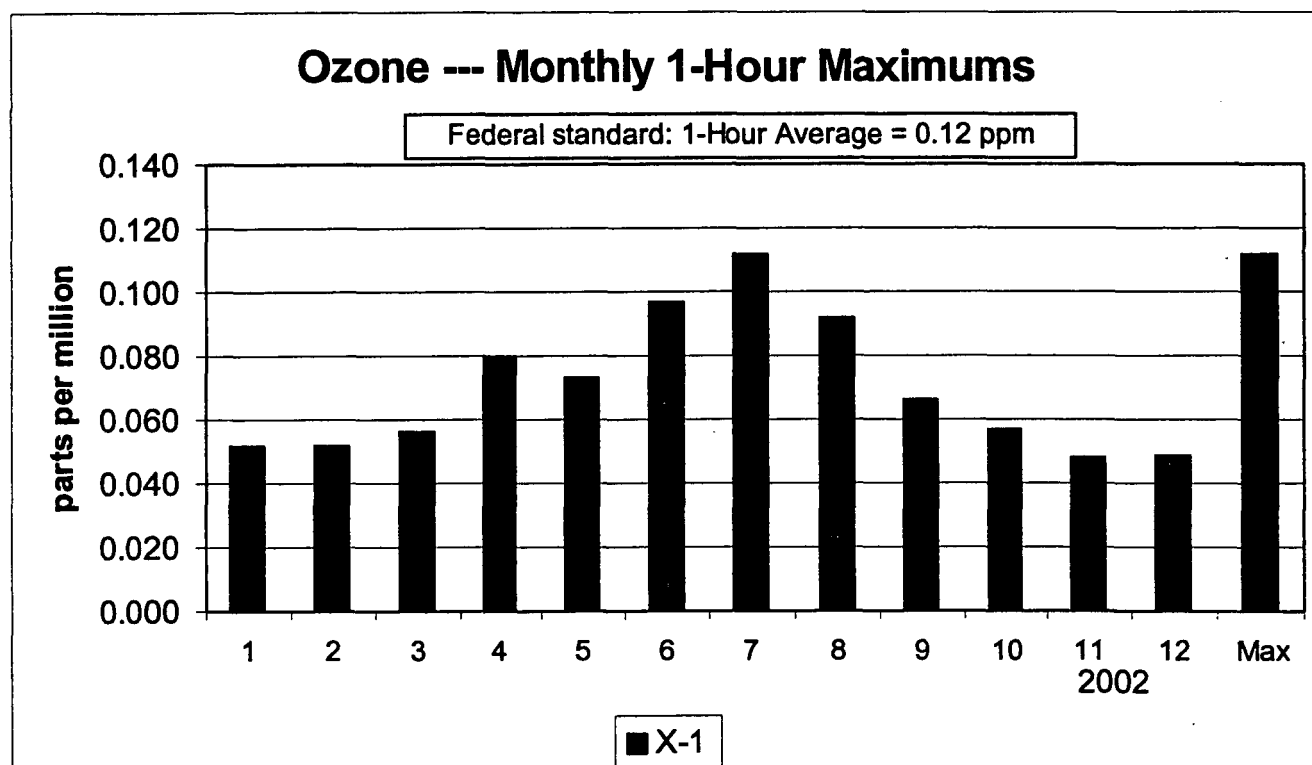
## Ozone

2001

### Monthly 1-Hour Maximum Data

(ppm)

|      | 2001  | Month |       |       |       |       |       |       |       |       |       |       | 2001  |
|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Site | 1     | 2     | 3     | 4     | 5     | 6     | 7     | 8     | 9     | 10    | 11    | 12    | Max   |
| X-1  | 0.052 | 0.052 | 0.056 | 0.080 | 0.073 | 0.097 | 0.112 | 0.092 | 0.066 | 0.057 | 0.048 | 0.049 | 0.112 |



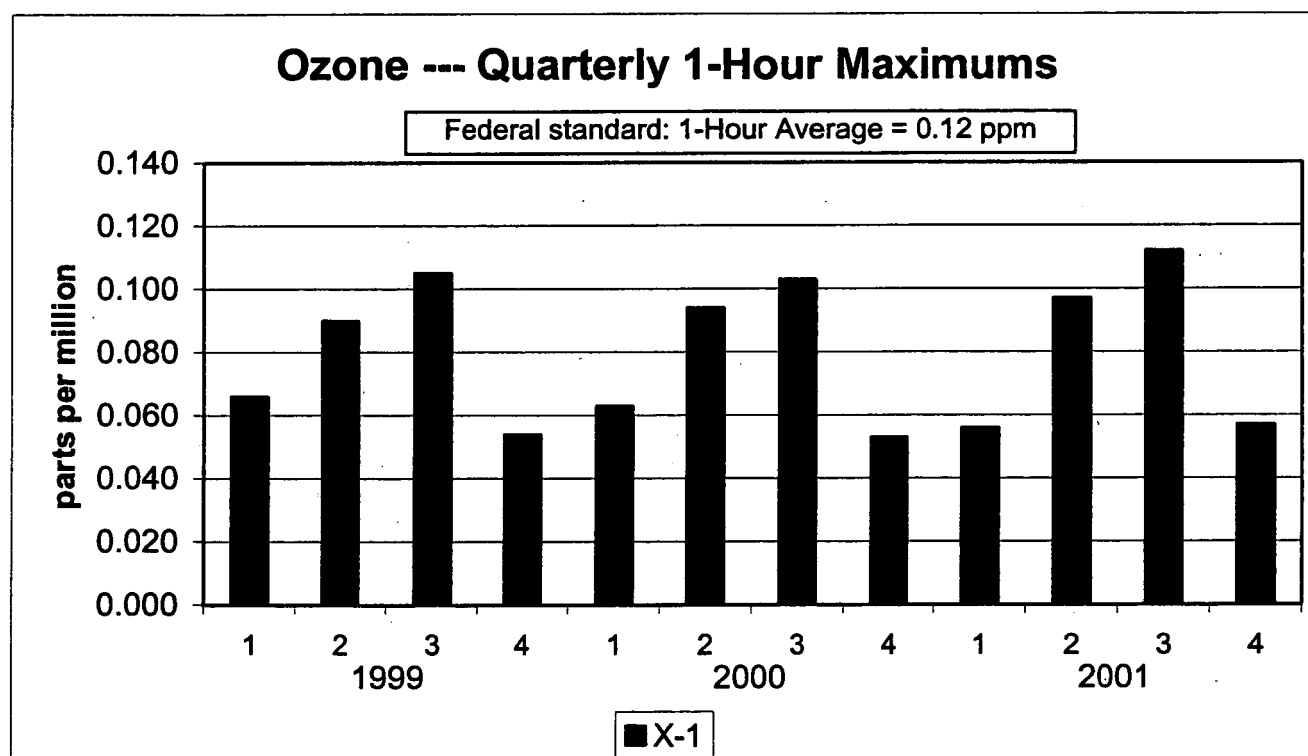
# AIR MONITORING AT RFETS

## Ozone

2001

Quarterly 1-Hour Maximum Data (3-years)  
(ppm)

|      | 1999  |       |       |       | 2000  |       |       |       | 2001 |      |      |      |
|------|-------|-------|-------|-------|-------|-------|-------|-------|------|------|------|------|
| Site | 1     | 2     | 3     | 4     | 1     | 2     | 3     | 4     | 1    | 2    | 3    | 4    |
| X-1  | 0.066 | 0.090 | 0.105 | 0.054 | 0.063 | 0.094 | 0.103 | 0.053 | .056 | .097 | .112 | .057 |



**APPENDIX H**

**RADIONUCLIDE AND  
METALS DATA**

## AIR MONITORING AT RFETS

### Total Suspended Particulates (TSP) Metals and Radionuclides 2001

#### Quarterly Composite Data ( $\mu\text{g}/\text{m}^3$ )

| TSP Site | Item      | Months 01-03 Composite | Months 04-06 Composite | Months 07-09 Composite | Months 10-12 Composite |
|----------|-----------|------------------------|------------------------|------------------------|------------------------|
| X-1      | Be        | <0.0011                | <0.0011                | X                      | X                      |
| X-1-C    | Be - Coll | <0.0011                | <0.0011                | X                      | X                      |
| X-2      | Be        | <0.0011                | <0.0011                | X                      | X                      |
| X-3      | Be        | <0.0011                | <0.0011                | X                      | X                      |
| X-4      | Be        | <0.0011                | <0.0011                | X                      | X                      |
| X-5      | Be        | <0.0011                | <0.0011                | X                      | X                      |

#### Quarterly Composite Data ( $\text{pCi}/\text{m}^3$ )

| TSP Site | Item         | Months 01-03 Composite | Months 04-06 Composite | Months 07-09 Composite | Months 10-12 Composite |
|----------|--------------|------------------------|------------------------|------------------------|------------------------|
| X-1      | U-234        | <0.000091              | <0.000068              | X                      | X                      |
| X-1-C    | U-234 - Coll | 0.000197               | <0.000065              | X                      | X                      |
| X-2      | U-234        | <0.000131              | <0.000218              | X                      | X                      |
| X-3      | U-234        | <0.000131              | 0.000104               | X                      | X                      |
| X-4      | U-234        | <0.000129              | <0.000083              | X                      | X                      |
| X-5      | U-234        | <0.000341              | 0.000140               | X                      | X                      |
|          |              |                        |                        |                        |                        |
| X-1      | U-235        | <0.000018              | <0.000014              | X                      | X                      |
| X-1-C    | U-235 - Coll | <0.000023              | <0.000013              | X                      | X                      |
| X-2      | U-235        | <0.000026              | <0.000044              | X                      | X                      |
| X-3      | U-235        | <0.000026              | <0.000014              | X                      | X                      |
| X-4      | U-235        | <0.000026              | <0.000017              | X                      | X                      |
| X-5      | U-235        | <0.00068               | <0.000013              | X                      | X                      |
|          |              |                        |                        |                        |                        |
| X-1      | U-238        | <0.000092              | <0.000068              | X                      | X                      |
| X-1-C    | U-238 - Coll | 0.000187               | 0.000112               | X                      | X                      |
| X-2      | U-238        | <0.000132              | <0.000221              | X                      | X                      |
| X-3      | U-238        | <0.000132              | 0.000091               | X                      | X                      |
| X-4      | U-238        | <0.000129              | <0.000084              | X                      | X                      |
| X-5      | U-238        | <0.000345              | 0.000138               | X                      | X                      |
|          |              |                        |                        |                        |                        |
| X-5      | Pu-239       | <0.000027              | <0.000027              | X                      | X                      |
| X-5      | Am-241       | <0.000083              | <0.000034              | X                      | X                      |

X = Not Available. Sampling terminated at the end of June 2001.

# **AIR MONITORING AT RFETS**

**PM<sub>10</sub>**

**Metals and Radionuclides**

**2001**

**Quarterly Composite Data**

**( $\mu\text{g}/\text{m}^3$ )**

| <b>PM-10<br/>Site</b> | <b>Item</b> | <b>Months 01-03<br/>Composite</b> | <b>Months 04-06<br/>Composite</b> | <b>Months 07-09<br/>Composite</b> | <b>Months 10-12<br/>Composite</b> |
|-----------------------|-------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
| X-1                   | Be          | <0.0011                           | <0.0011                           |                                   |                                   |
| X-2                   | Be          | <0.0011                           | <0.0011                           |                                   |                                   |
| X-2-C                 | Be - Coll   | <0.0011                           | <0.0011                           |                                   |                                   |
| X-3                   | Be          | <0.0011                           | <0.0011                           |                                   |                                   |
| X-4                   | Be          | <0.0011                           | <0.0011                           |                                   |                                   |
| X-5                   | Be          | <0.0011                           | <0.0011                           |                                   |                                   |

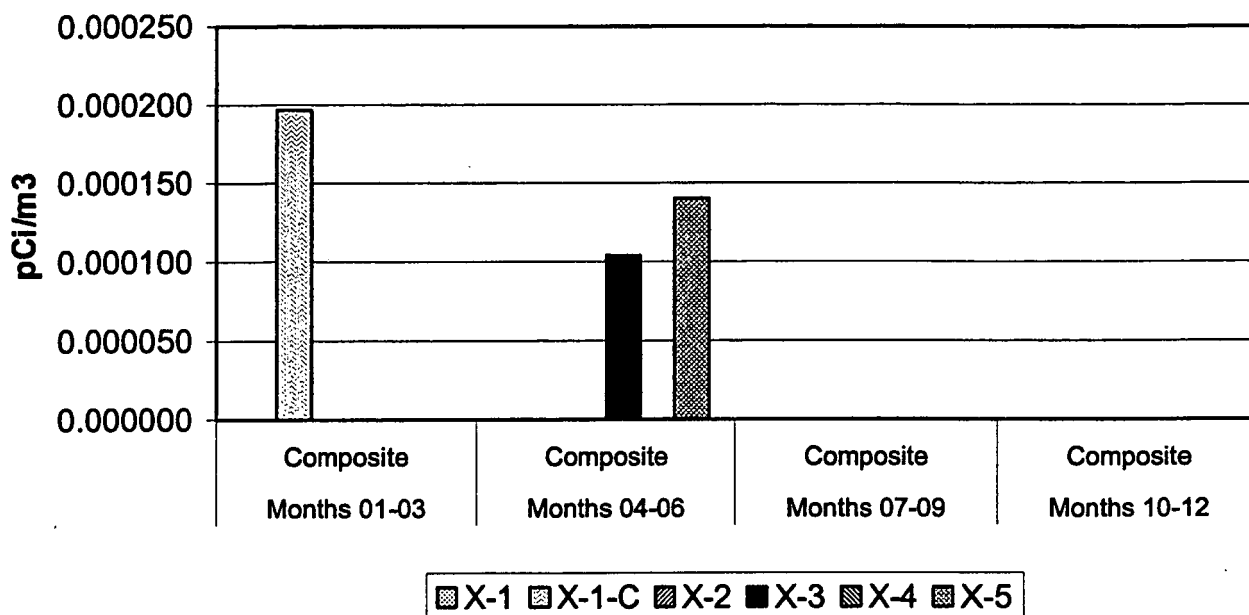
**Quarterly Composite Data**

**(pCi/m<sup>3</sup>)**

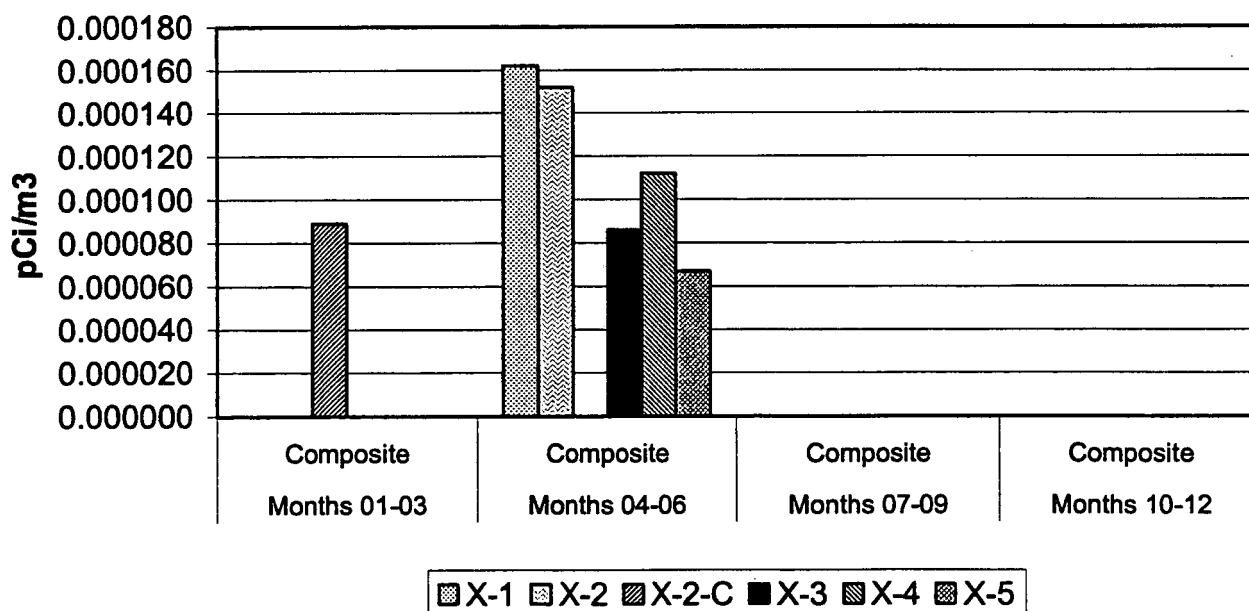
| <b>PM-10<br/>Site</b> | <b>Item</b>  | <b>Months 01-03<br/>Composite</b> | <b>Months 04-06<br/>Composite</b> | <b>Months 07-09<br/>Composite</b> | <b>Months 10-12<br/>Composite</b> |
|-----------------------|--------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
| X-1                   | U-234        | <0.000067                         | 0.000162                          | X                                 | X                                 |
| X-2                   | U-234        | <0.000050                         | 0.000152                          | X                                 | X                                 |
| X-2-C                 | U-234 - Coll | 0.000089                          | <0.000058                         | X                                 | X                                 |
| X-3                   | U-234        | <0.000125                         | 0.000086                          | X                                 | X                                 |
| X-4                   | U-234        | <0.000079                         | 0.000112                          | X                                 | X                                 |
| X-5                   | U-234        | <0.000150                         | 0.000067                          | X                                 | X                                 |
|                       |              |                                   |                                   |                                   |                                   |
| X-1                   | U-235        | <0.000013                         | <0.000013                         | X                                 | X                                 |
| X-2                   | U-235        | <0.000010                         | <0.000013                         | X                                 | X                                 |
| X-2-C                 | U-235 - Coll | <0.000012                         | <0.000012                         | X                                 | X                                 |
| X-3                   | U-235        | <0.000025                         | <0.000011                         | X                                 | X                                 |
| X-4                   | U-235        | <0.000016                         | <0.000011                         | X                                 | X                                 |
| X-5                   | U-235        | <0.000030                         | <0.000013                         | X                                 | X                                 |
|                       |              |                                   |                                   |                                   |                                   |
| X-1                   | U-238        | <0.000067                         | 0.000159                          | X                                 | X                                 |
| X-2                   | U-238        | <0.000051                         | 0.000182                          | X                                 | X                                 |
| X-2-C                 | U-238 - Coll | 0.000082                          | 0.000061                          | X                                 | X                                 |
| X-3                   | U-238        | <0.000126                         | 0.000091                          | X                                 | X                                 |
| X-4                   | U-238        | 0.000079                          | 0.000090                          | X                                 | X                                 |
| X-5                   | U-238        | <0.000151                         | 0.000077                          | X                                 | X                                 |
|                       |              |                                   |                                   |                                   |                                   |
| X-5                   | Pu-239       | <0.000004                         | <0.000005                         | X                                 | X                                 |
| X-5                   | Am-241       | <0.000014                         | <0.000017                         | X                                 | X                                 |

X = Not Available. Sampling terminated at the end of June 2001.

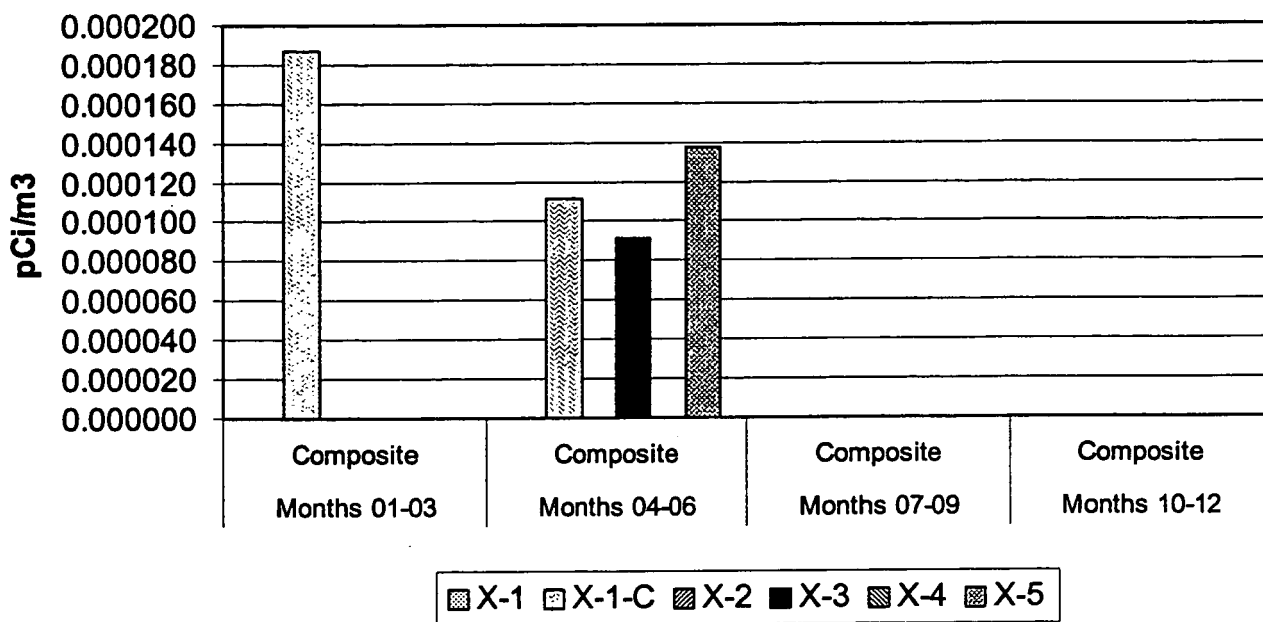
## Uranium-234 In TSP



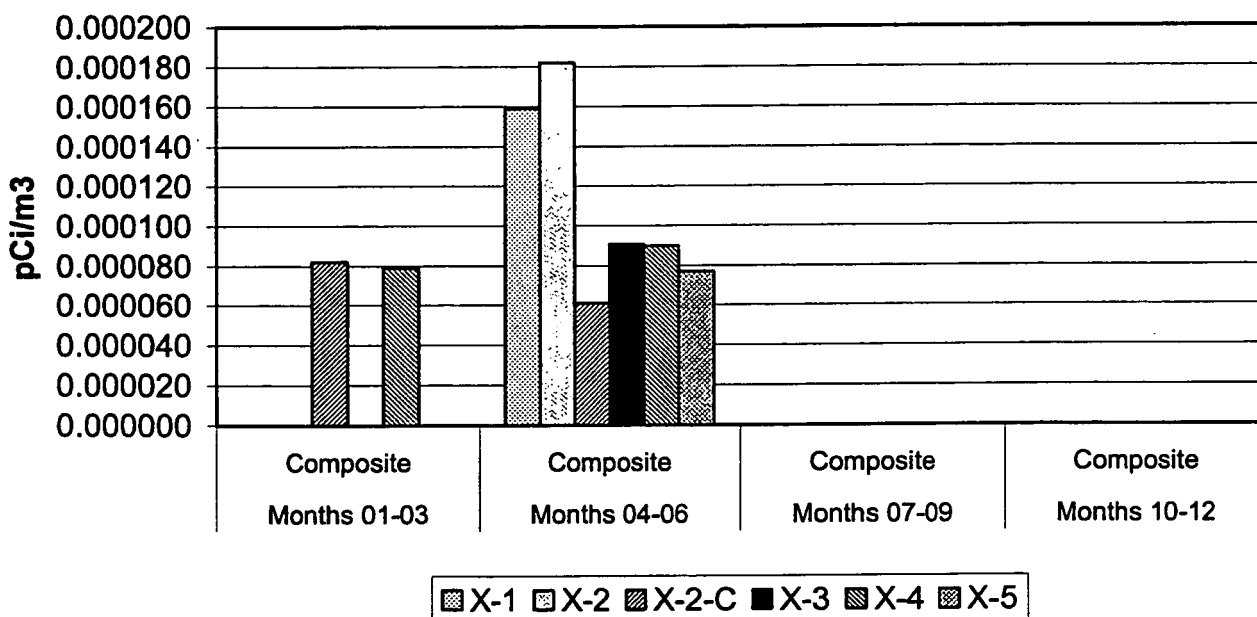
## Uranium-234 In PM10



## Uranium-238 In TSP



## Uranium-238 In PM10





# **APPENDIX I**

## **METEOROLOGICAL DATA**

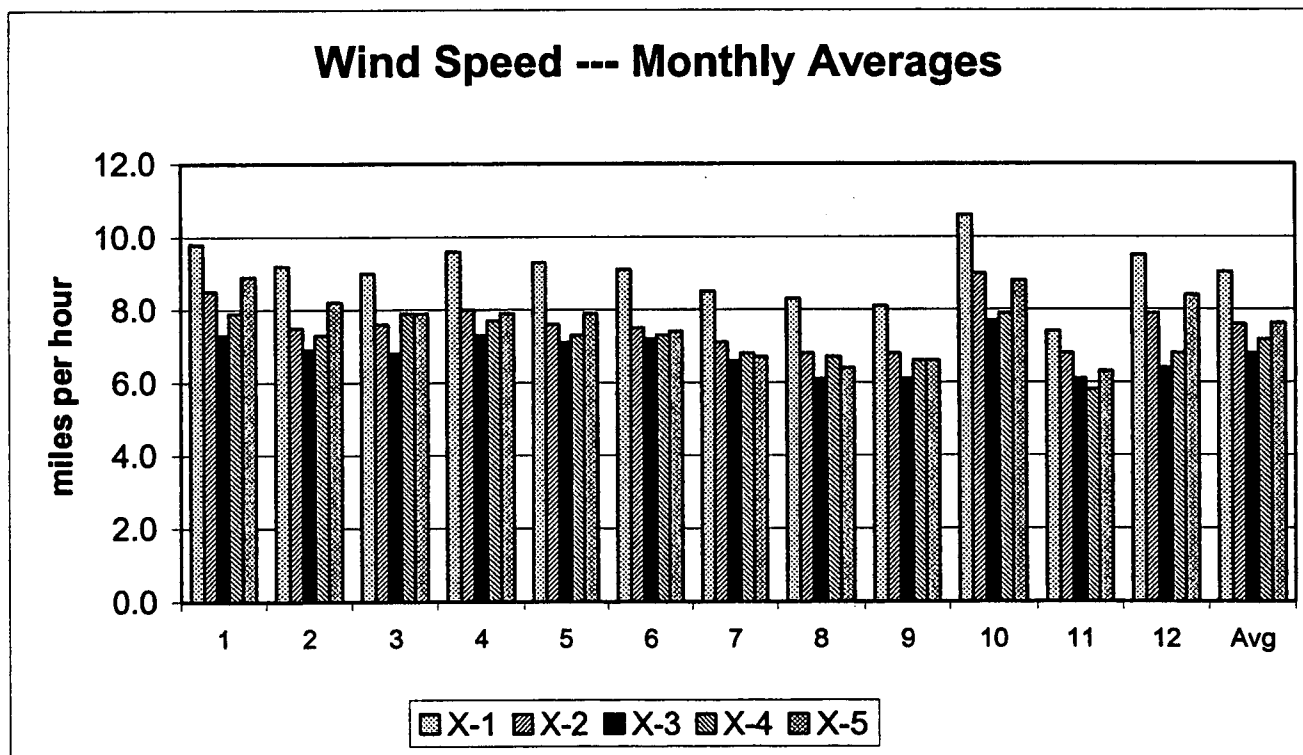
# **AIR MONITORING AT RFETS**

## **Wind Speed (vector)**

**2001**

### **Monthly Arithmetic Average Data (miles per hour)**

| Month       |          |          |          |          |          |          |          |          |          |           |           |           |            |
|-------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|-----------|-----------|------------|
| <b>Site</b> | <b>1</b> | <b>2</b> | <b>3</b> | <b>4</b> | <b>5</b> | <b>6</b> | <b>7</b> | <b>8</b> | <b>9</b> | <b>10</b> | <b>11</b> | <b>12</b> | <b>Avg</b> |
| <b>X-1</b>  | 9.8      | 9.2      | 9.0      | 9.6      | 9.3      | 9.1      | 8.5      | 8.3      | 8.1      | 10.6      | 7.4       | 9.5       | 9.0        |
| <b>X-2</b>  | 8.5      | 7.5      | 7.6      | 8.0      | 7.6      | 7.5      | 7.1      | 6.8      | 6.8      | 9.0       | 6.8       | 7.9       | 7.6        |
| <b>X-3</b>  | 7.3      | 6.9      | 6.8      | 7.3      | 7.1      | 7.2      | 6.6      | 6.1      | 6.1      | 7.7       | 6.1       | 6.4       | 6.8        |
| <b>X-4</b>  | 7.9      | 7.3      | 7.9      | 7.7      | 7.3      | 7.3      | 6.8      | 6.7      | 6.6      | 7.9       | 5.8       | 6.8       | 7.2        |
| <b>X-5</b>  | 8.9      | 8.2      | 7.9      | 7.9      | 7.9      | 7.4      | 6.7      | 6.4      | 6.6      | 8.8       | 6.3       | 8.4       | 7.6        |



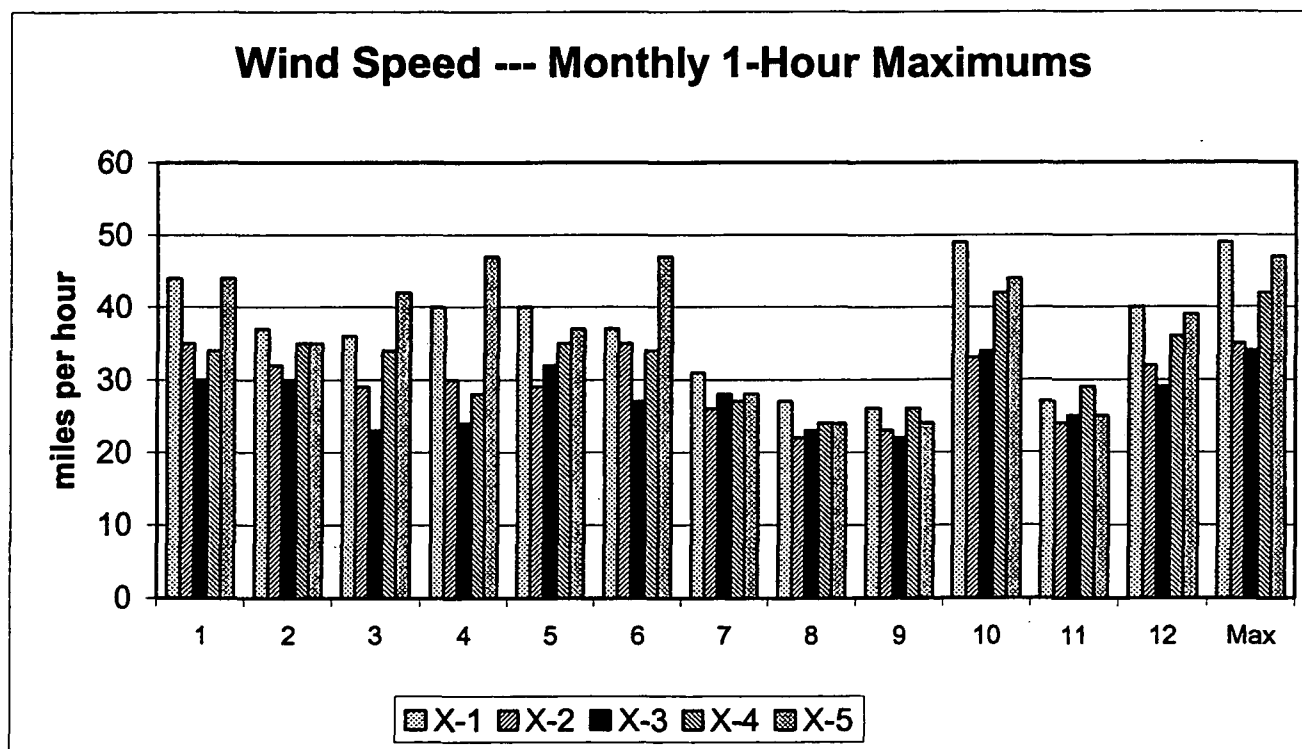
# AIR MONITORING AT RFETS

## Wind Speed (vector)

2001

### Monthly 1-Hour Maximum Data (miles per hour)

| Month |    |    |    |    |    |    |    |    |    |    |    |    |     |
|-------|----|----|----|----|----|----|----|----|----|----|----|----|-----|
| Site  | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 | Max |
| X-1   | 44 | 37 | 36 | 40 | 40 | 37 | 31 | 27 | 26 | 49 | 27 | 40 | 49  |
| X-2   | 35 | 32 | 29 | 30 | 29 | 35 | 26 | 22 | 23 | 33 | 24 | 32 | 35  |
| X-3   | 30 | 30 | 23 | 24 | 32 | 27 | 28 | 23 | 22 | 34 | 25 | 29 | 34  |
| X-4   | 34 | 35 | 34 | 28 | 35 | 34 | 27 | 24 | 26 | 42 | 29 | 36 | 42  |
| X-5   | 44 | 35 | 42 | 47 | 37 | 47 | 28 | 24 | 24 | 44 | 25 | 39 | 47  |



# AIR MONITORING AT RFETS

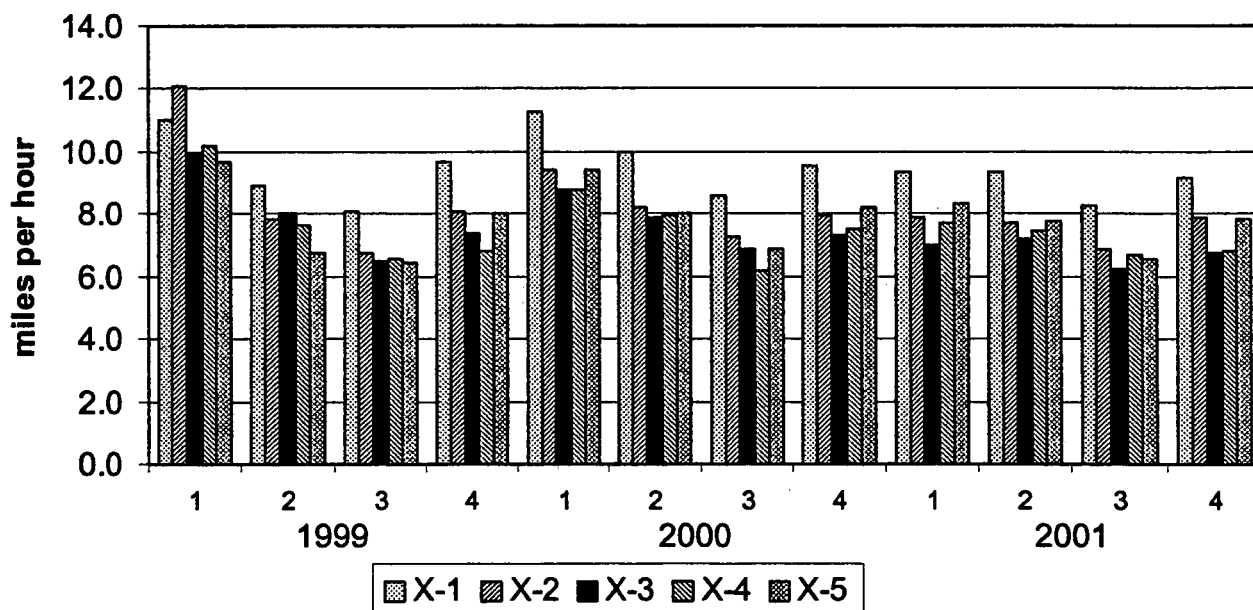
## Wind Speed (vector)

2001

Quarterly Arithmetic Average Data (3-years)  
(miles per hour)

|      | 1999 |     |     |     | 2000 |      |     |     | 2001 |     |     |     |
|------|------|-----|-----|-----|------|------|-----|-----|------|-----|-----|-----|
| Site | 1    | 2   | 3   | 4   | 1    | 2    | 3   | 4   | 1    | 2   | 3   | 4   |
| X-1  | 11.0 | 8.9 | 8.1 | 9.7 | 11.2 | 10.0 | 8.6 | 9.6 | 9.3  | 9.3 | 8.3 | 9.2 |
| X-2  | 12.1 | 7.8 | 6.8 | 8.1 | 9.4  | 8.2  | 7.3 | 7.9 | 7.9  | 7.7 | 6.9 | 7.9 |
| X-3  | 9.9  | 8.0 | 6.5 | 7.4 | 8.8  | 7.9  | 6.9 | 7.3 | 7.0  | 7.2 | 6.3 | 6.7 |
| X-4  | 10.2 | 7.7 | 6.5 | 6.8 | 8.8  | 7.9  | 6.2 | 7.5 | 7.7  | 7.4 | 6.7 | 6.8 |
| X-5  | 9.7  | 6.8 | 6.4 | 8.0 | 9.4  | 8.0  | 6.9 | 8.2 | 8.3  | 7.7 | 6.6 | 7.8 |

## Wind Speed --- Quarterly Averages



# AIR MONITORING AT RFETS

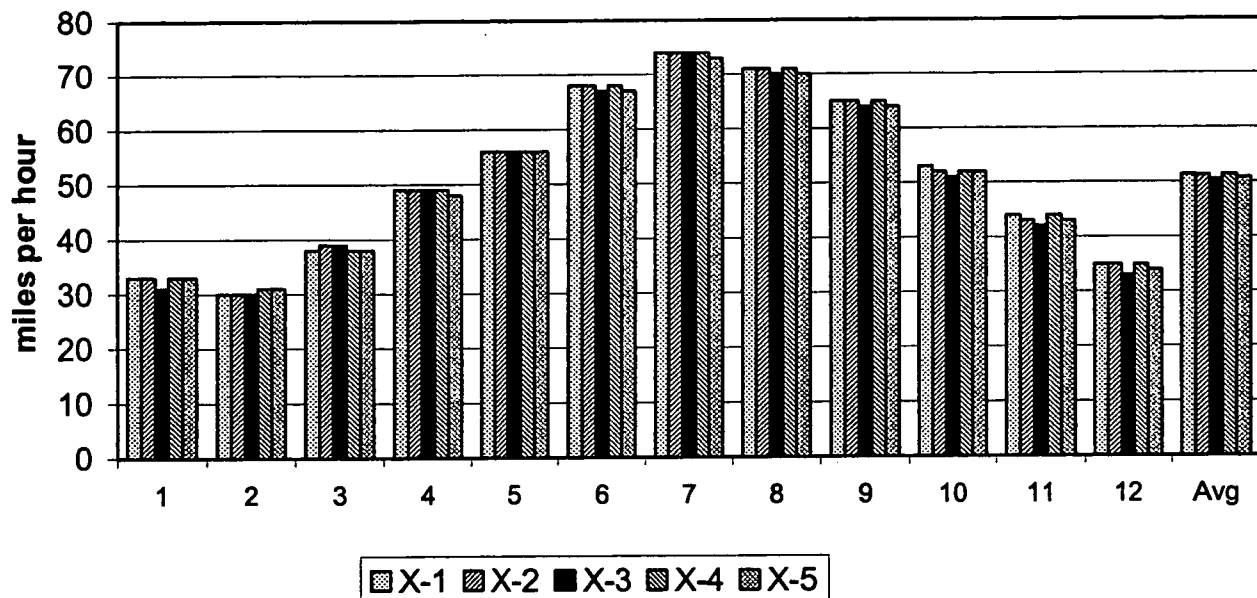
## Temperature

2001

### Monthly Arithmetic Average Data (Degrees Fahrenheit)

| Month |    |    |    |    |    |    |    |    |    |    |    |    |     |
|-------|----|----|----|----|----|----|----|----|----|----|----|----|-----|
| Site  | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 | Avg |
| X-1   | 33 | 30 | 38 | 49 | 56 | 68 | 74 | 71 | 65 | 53 | 44 | 35 | 51  |
| X-2   | 33 | 30 | 39 | 49 | 56 | 68 | 74 | 71 | 65 | 52 | 43 | 35 | 51  |
| X-3   | 31 | 30 | 39 | 49 | 56 | 67 | 74 | 70 | 64 | 51 | 42 | 33 | 51  |
| X-4   | 33 | 31 | 38 | 49 | 56 | 68 | 74 | 71 | 65 | 52 | 44 | 35 | 51  |
| X-5   | 33 | 31 | 38 | 48 | 56 | 67 | 73 | 70 | 64 | 52 | 43 | 34 | 51  |

### Temperature --- Monthly Averages



# AIR MONITORING AT RFETS

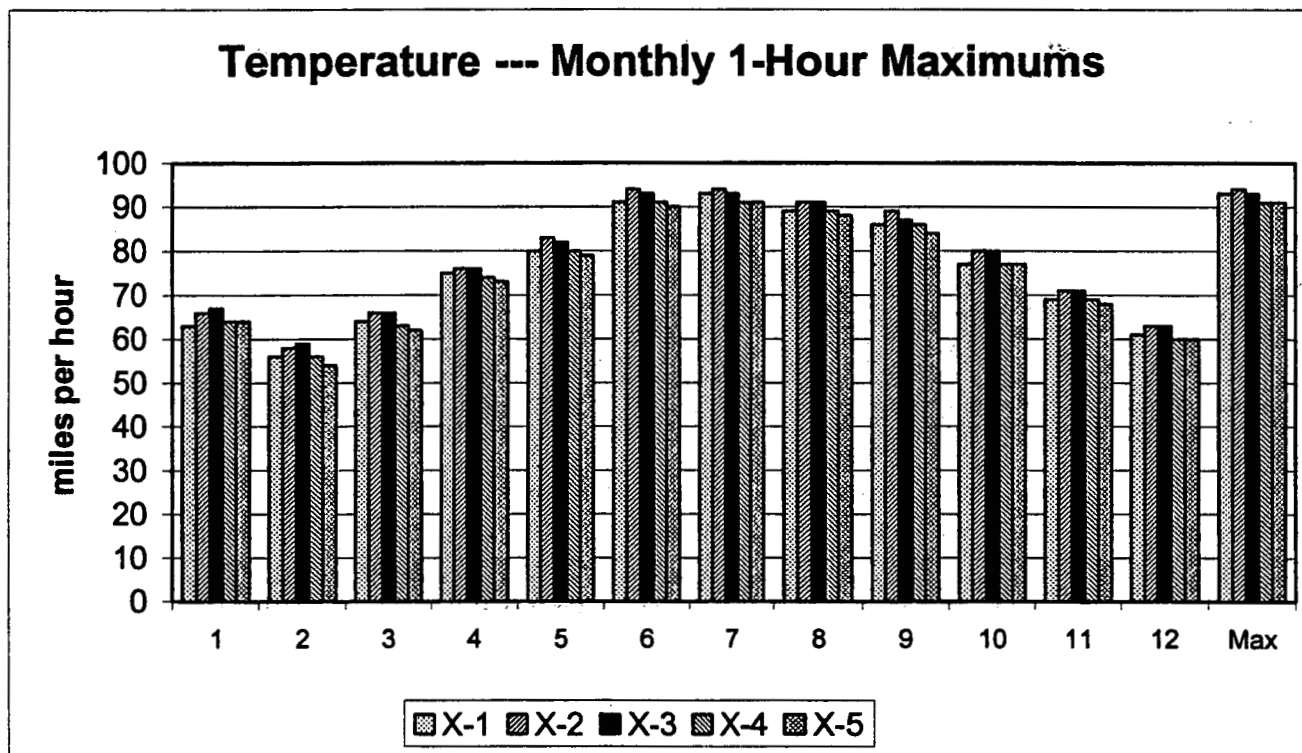
## Temperature

2001

### Monthly 1-Hour Maximum Data

(Degrees Fahrenheit)

| Month |    |    |    |    |    |    |    |    |    |    |    |    |     |
|-------|----|----|----|----|----|----|----|----|----|----|----|----|-----|
| Site  | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 | Max |
| X-1   | 63 | 56 | 64 | 75 | 80 | 91 | 93 | 89 | 86 | 77 | 69 | 61 | 93  |
| X-2   | 66 | 58 | 66 | 76 | 83 | 94 | 94 | 91 | 89 | 80 | 71 | 63 | 94  |
| X-3   | 67 | 59 | 66 | 76 | 82 | 93 | 93 | 91 | 87 | 80 | 71 | 63 | 93  |
| X-4   | 64 | 56 | 63 | 74 | 80 | 91 | 91 | 89 | 86 | 77 | 69 | 60 | 91  |
| X-5   | 64 | 54 | 62 | 73 | 79 | 90 | 91 | 88 | 84 | 77 | 68 | 60 | 91  |



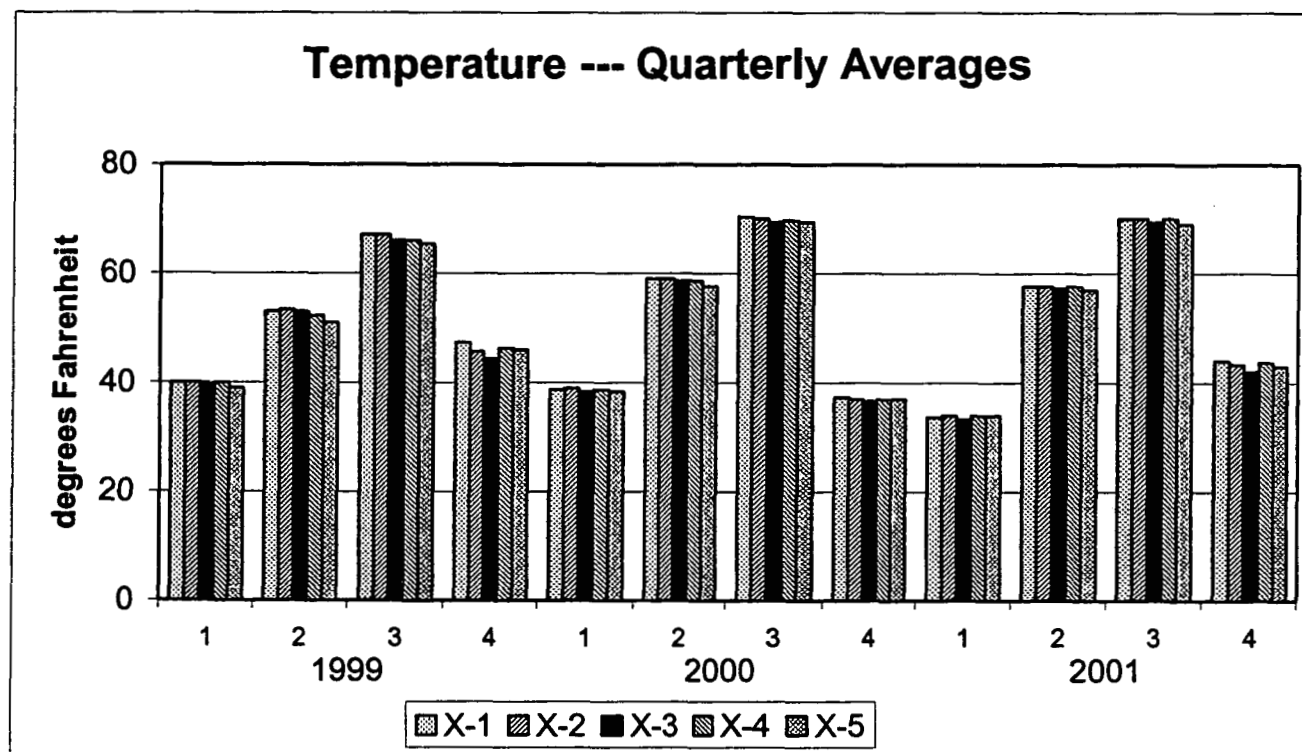
# AIR MONITORING AT RFETS

## Temperature

2001

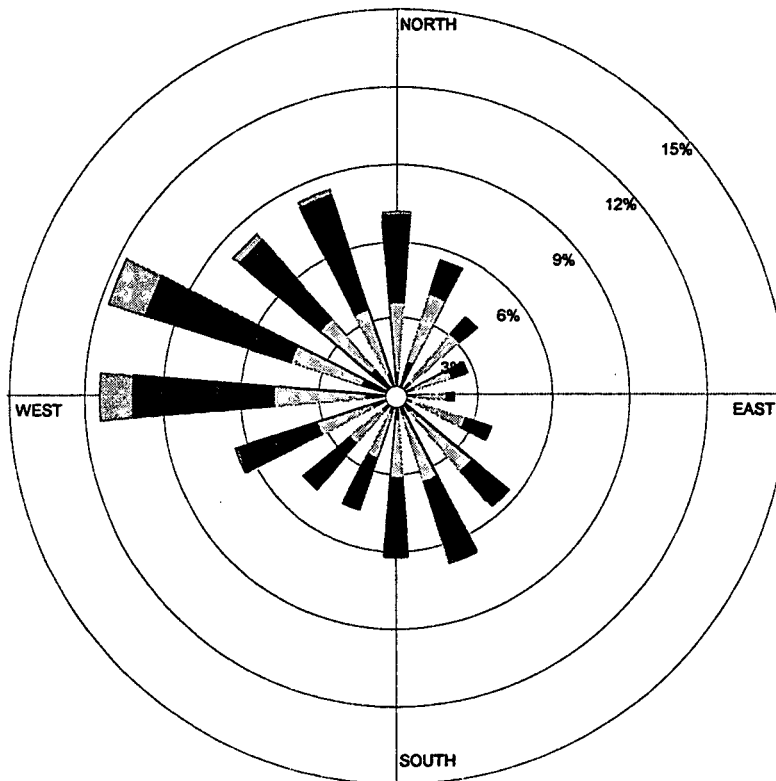
Quarterly Arithmetic Average Data (3-years)  
(degrees Fahrenheit)

|      | 1999 |      |      |      | 2000 |      |      |      | 2001 |      |      |      |
|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Site | 1    | 2    | 3    | 4    | 1    | 2    | 3    | 4    | 1    | 2    | 3    | 4    |
| X-1  | 40.0 | 53.0 | 67.0 | 47.3 | 38.7 | 59.0 | 70.3 | 37.3 | 34.0 | 58.0 | 70.0 | 44.0 |
| X-2  | 40.0 | 53.3 | 67.0 | 45.7 | 39.0 | 59.0 | 70.0 | 37.0 | 34.0 | 58.0 | 70.0 | 43.0 |
| X-3  | 39.7 | 53.0 | 66.0 | 44.3 | 38.3 | 58.7 | 69.3 | 36.7 | 33.0 | 57.0 | 69.0 | 42.0 |
| X-4  | 40.0 | 52.3 | 66.0 | 46.3 | 38.7 | 58.7 | 69.7 | 37.0 | 34.0 | 58.0 | 70.0 | 44.0 |
| X-5  | 39.0 | 51.0 | 65.3 | 46.0 | 38.3 | 57.7 | 69.3 | 37.0 | 34.0 | 57.0 | 69.0 | 43.0 |



WIND ROSE PLOT:  
Rocky Flats (X-1) 08 059 0006

DISPLAY:  
Wind Speed  
Direction (blowing from)



COMMENTS:

DATA PERIOD:

2001  
Jan 1 - Dec 31  
00:00 - 23:00

COMPANY NAME:

Colorado Air Pollution Control Division

MODELER:

Bill Hague

CALM WINDS:

0.52%

TOTAL COUNT:

8637 hrs.

AVG. WIND SPEED:

4.40 m/s

DATE:

2/13/2003

PROJECT NO.:

WRPLOT View - Lakes Environmental Software

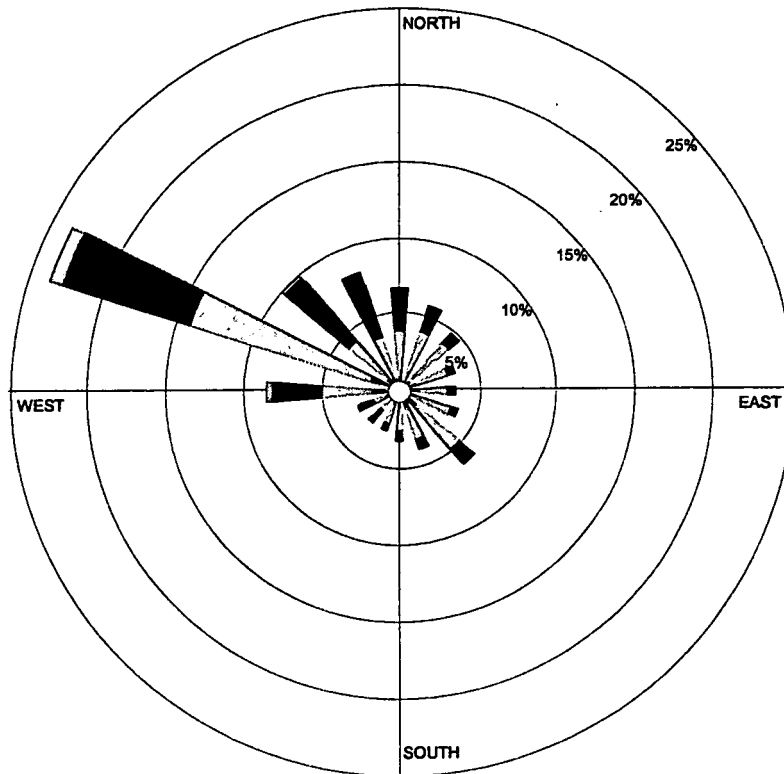


WIND ROSE PLOT:

Rocky Flats (X-2) 08 059 0007

DISPLAY:

Wind Speed  
Direction (blowing from)



COMMENTS:

DATA PERIOD:

2001  
Jan 1 - Dec 31  
00:00 - 23:00

COMPANY NAME:

Colorado Air Pollution Control Division

MODELER:

Bill Hague

CALM WINDS:

0.06%

TOTAL COUNT:

8163 hrs.

AVG. WIND SPEED:

3.72 m/s

DATE:

2/13/2003

PROJECT NO.:

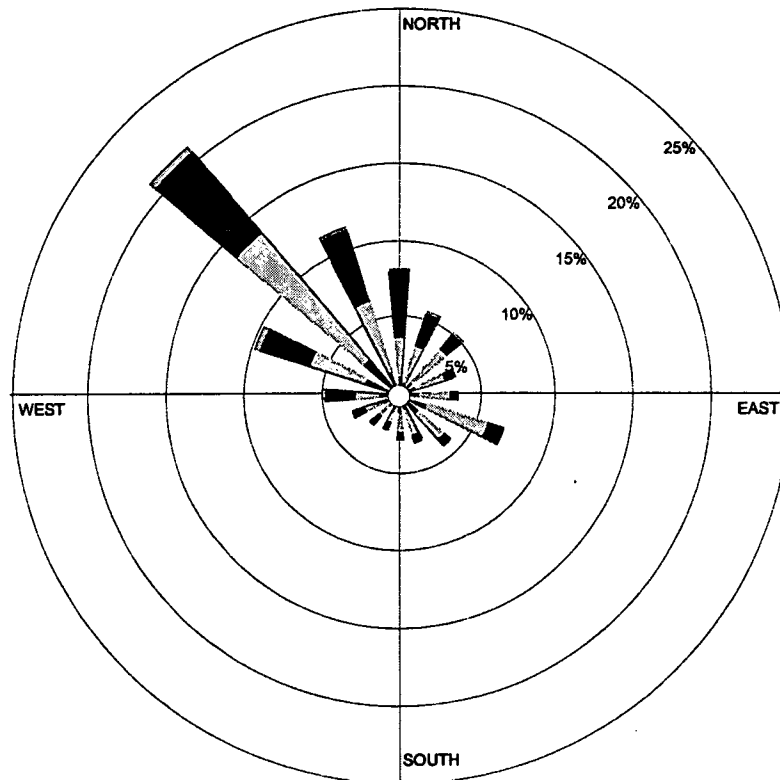
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

Rocky Flats (X-3) 08 059 0008

DISPLAY:

Wind Speed  
Direction (blowing from)



COMMENTS:

DATA PERIOD:

2001  
Jan 1 - Dec 31  
00:00 - 23:00

COMPANY NAME:

Colorado Air Pollution Control Division

MODELER:

Bill Hague

CALM WINDS:

1.56%

TOTAL COUNT:

8715 hrs.

AVG. WIND SPEED:

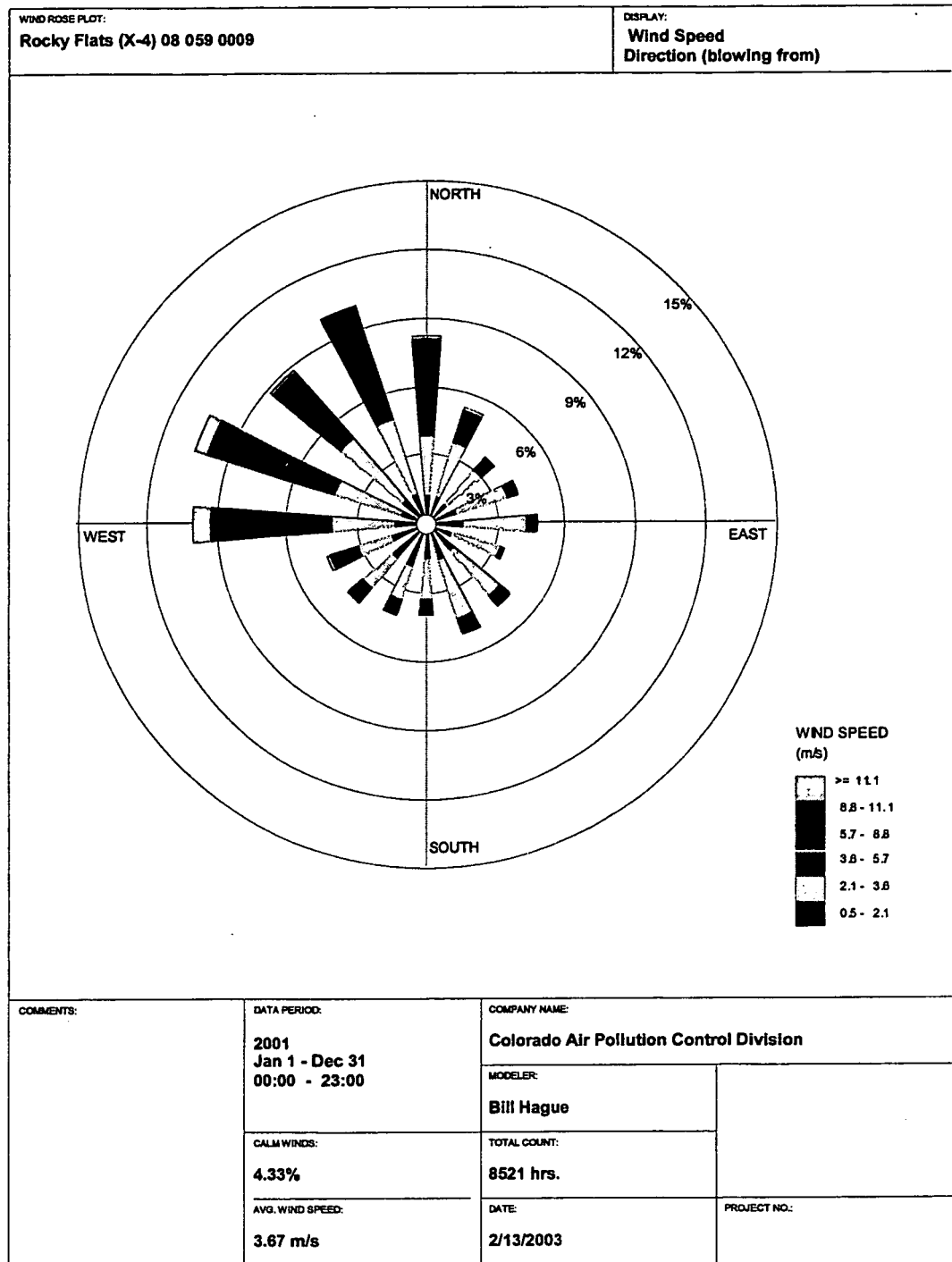
3.75 m/s

DATE:

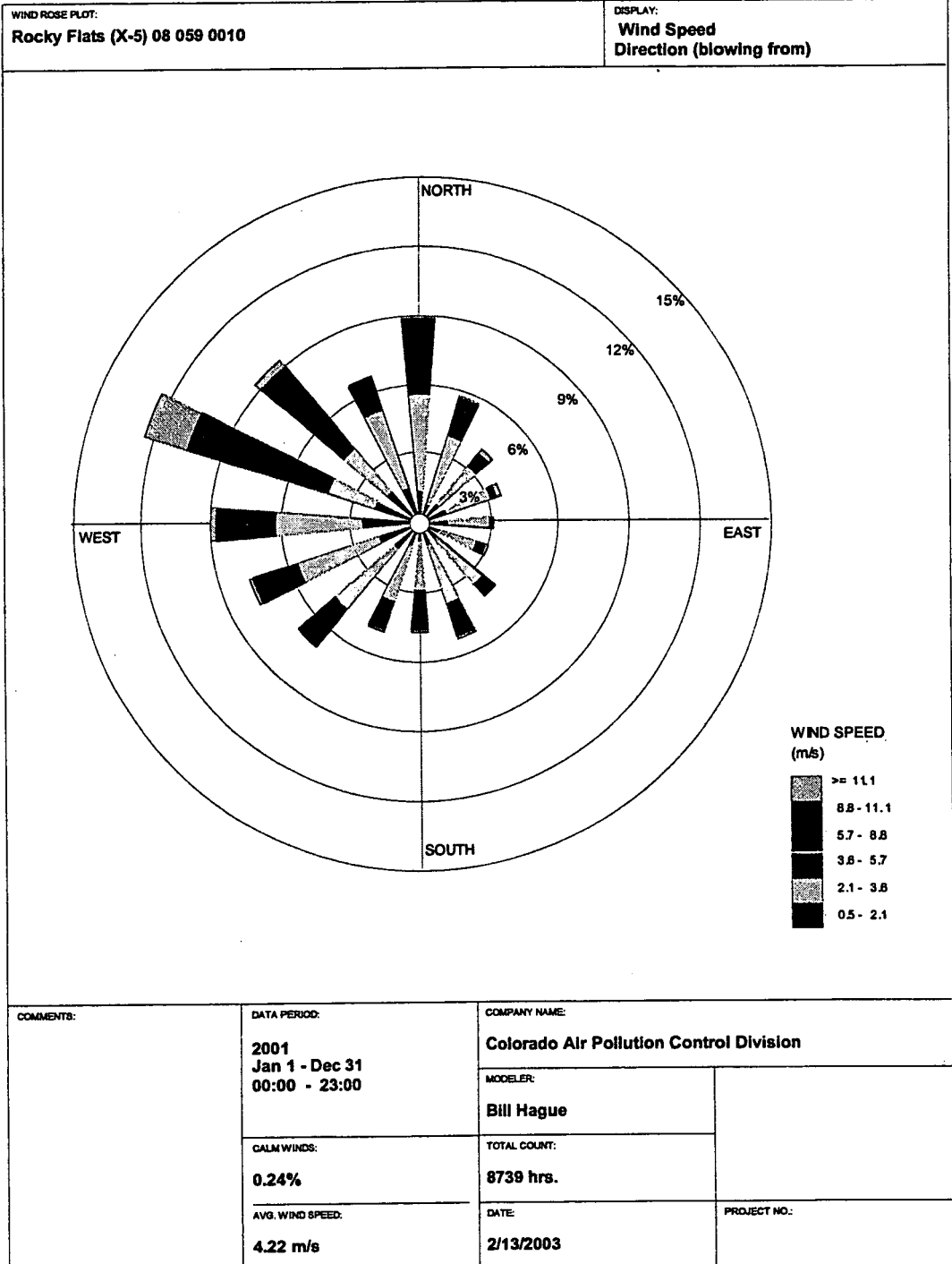
2/13/2003

PROJECT NO.:

WRPLOT View - Lakes Environmental Software



WRPLOT View - Lakes Environmental Software



WRPLOT View - Lakes Environmental Software

# **APPENDIX J**

## **COMPARISON DATA**

## Total Suspended Particulates (TSP) Comparison 2001

### Monthly Arithmetic Average Data ( $\mu\text{g}/\text{m}^3$ )

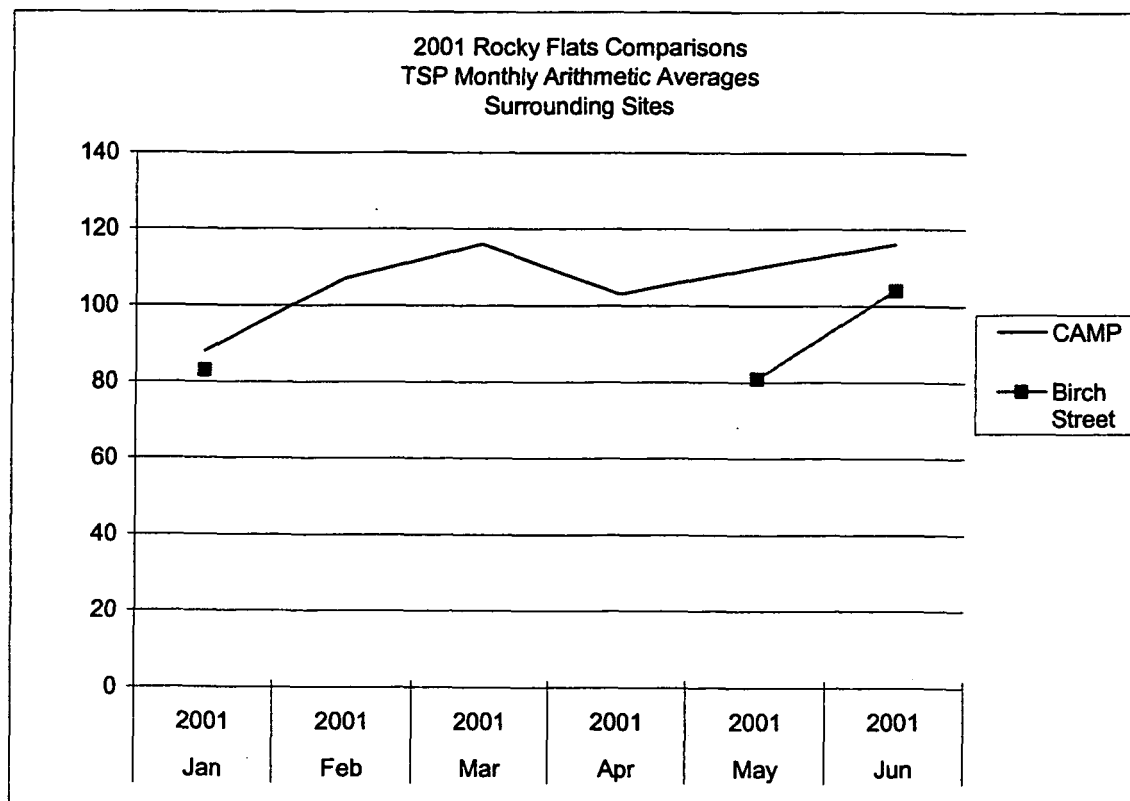
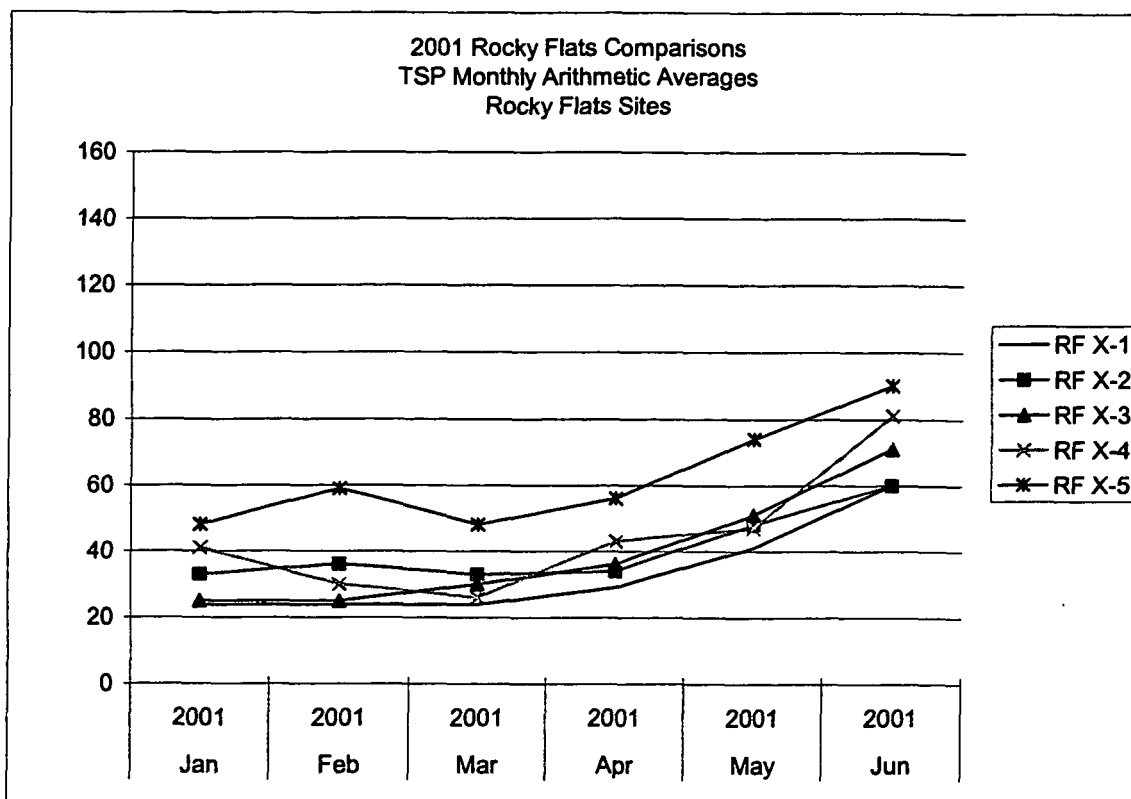
|     |      | RF X-1 | RF X-2 | RF X-3 | RF X-4 | RF X-5 | CAMP | Birch Street<br>Commerce<br>City |
|-----|------|--------|--------|--------|--------|--------|------|----------------------------------|
| Jan | 2001 | 24     | 33     | 25     | 41     | 48     | 88   | 83                               |
| Feb | 2001 | 24     | 36     | 25     | 30     | 59     | 107  | NA                               |
| Mar | 2001 | 24     | 33     | 30     | 26     | 48     | 116  | NA                               |
| Apr | 2001 | 29     | 34     | 36     | 43     | 56     | 103  | NA                               |
| May | 2001 | 41     | 48     | 51     | 47     | 74     | 110  | 81                               |
| Jun | 2001 | 60     | 60     | 71     | 81     | 90     | 116  | 104                              |
| Jul | 2001 | X      | X      | X      | X      | X      | 105  | 92                               |
| Aug | 2001 | X      | X      | X      | X      | X      | 87   | 84                               |
| Sep | 2001 | X      | X      | X      | X      | X      | 93   | 111                              |
| Oct | 2001 | X      | X      | X      | X      | X      | 115  | 100                              |
| Nov | 2001 | X      | X      | X      | X      | X      | 97   | 114                              |
| Dec | 2001 | X      | X      | X      | X      | X      | 94   | 80                               |

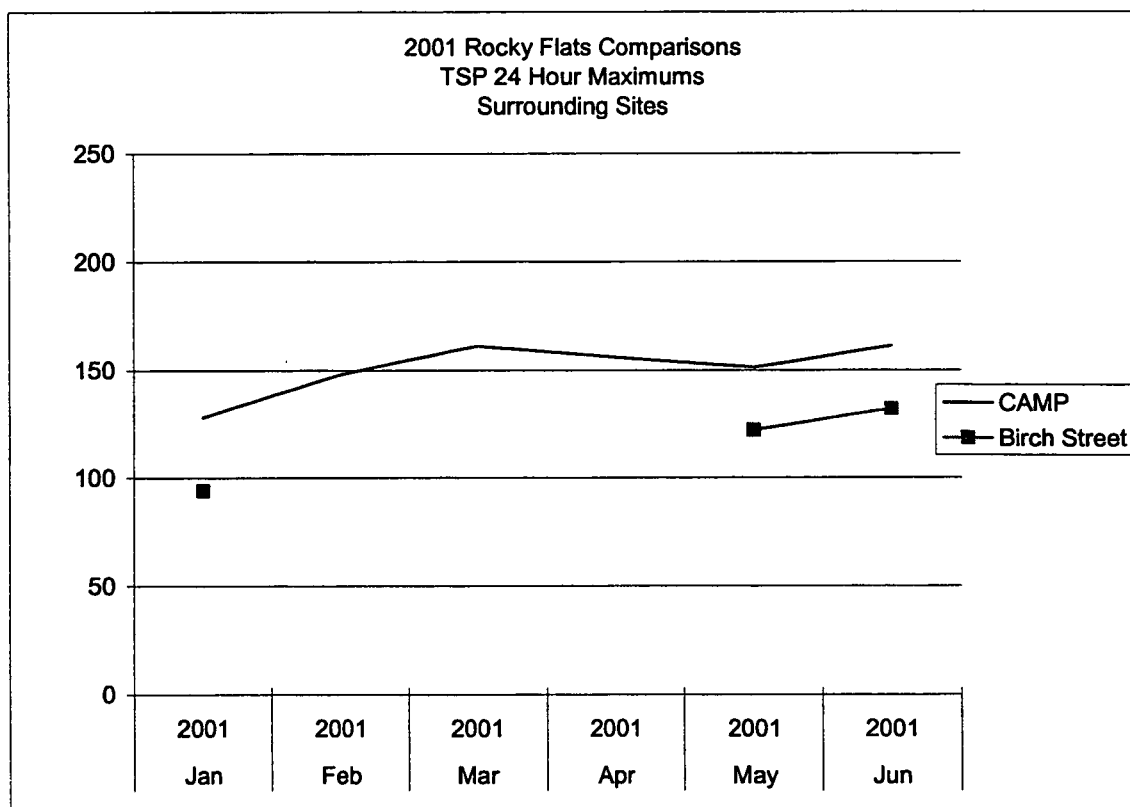
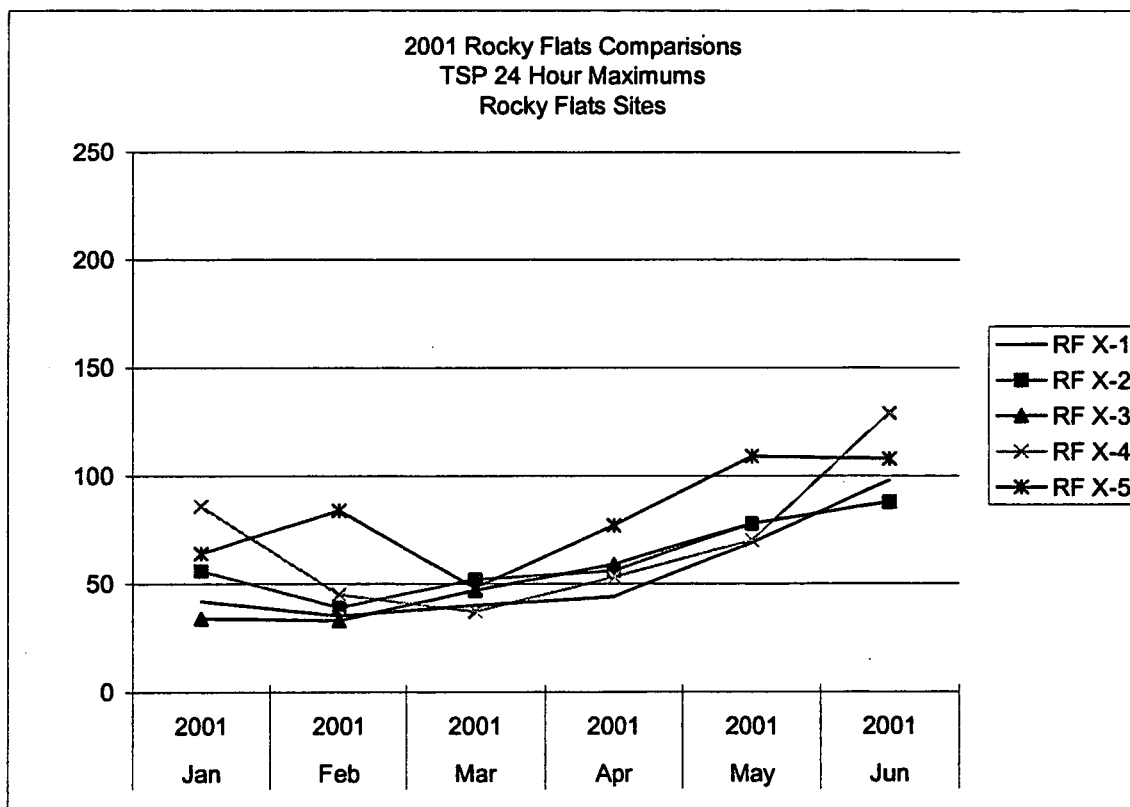
X = Not Available. Sampling terminated at the end of June 2001.

### Monthly 24-Hour Maximum Data ( $\mu\text{g}/\text{m}^3$ )

|     |      | RF X-1 | RF X-2 | RF X-3 | RF X-4 | RF X-5 | CAMP | Birch Street<br>Commerce<br>City |
|-----|------|--------|--------|--------|--------|--------|------|----------------------------------|
| Jan | 2001 | 42     | 56     | 34     | 86     | 64     | 128  | 94                               |
| Feb | 2001 | 35     | 39     | 33     | 45     | 84     | 148  | NA                               |
| Mar | 2001 | 40     | 52     | 47     | 37     | 48     | 161  | NA                               |
| Apr | 2001 | 44     | 56     | 59     | 53     | 77     | 156  | NA                               |
| May | 2001 | 69     | 78     | 78     | 70     | 109    | 151  | 122                              |
| Jun | 2001 | 98     | 88     | 88     | 129    | 108    | 161  | 132                              |
| Jul | 2001 | X      | X      | X      | X      | X      | 136  | 115                              |
| Aug | 2001 | X      | X      | X      | X      | X      | 146  | 117                              |
| Sep | 2001 | X      | X      | X      | X      | X      | 164  | 211                              |
| Oct | 2001 | X      | X      | X      | X      | X      | 151  | 149                              |
| Nov | 2001 | X      | X      | X      | X      | X      | 141  | 151                              |
| Dec | 2001 | X      | X      | X      | X      | X      | 160  | 110                              |

X = Not Available. Sampling terminated at the end of June 2001.







# **PM<sub>10</sub> Comparison 2001**

## **Monthly Arithmetic Average Data (µg/m<sup>3</sup>)**

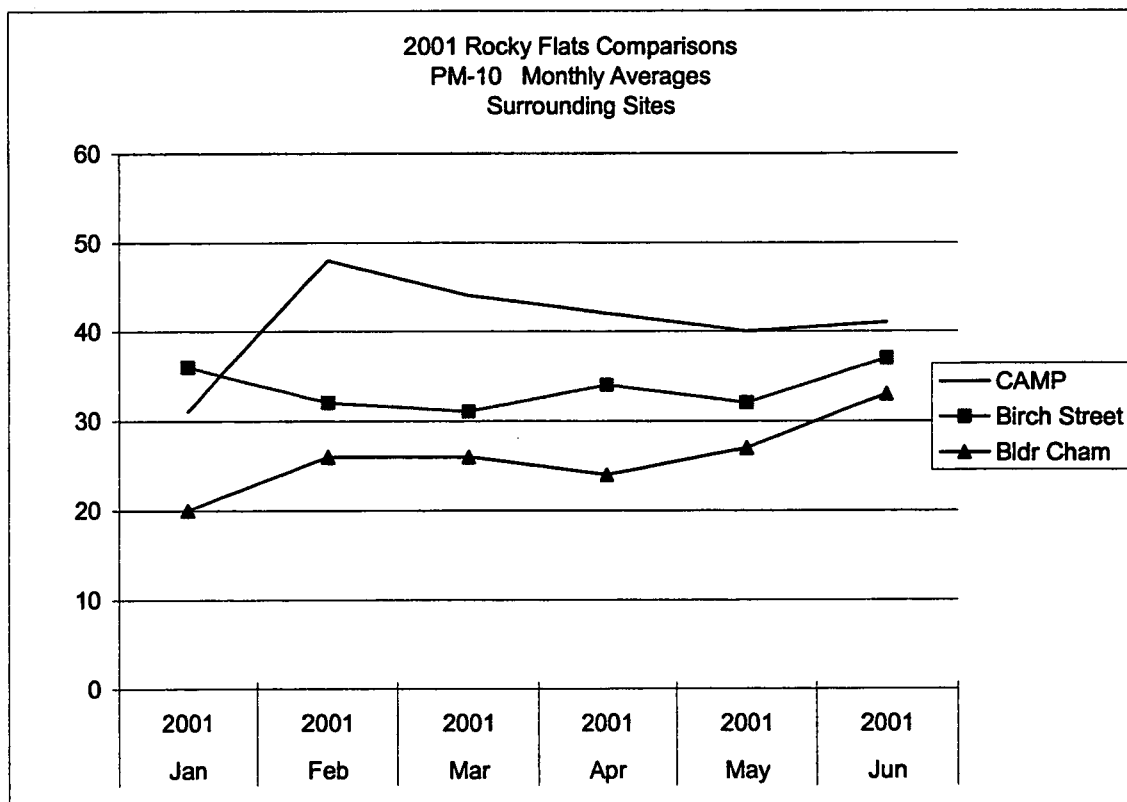
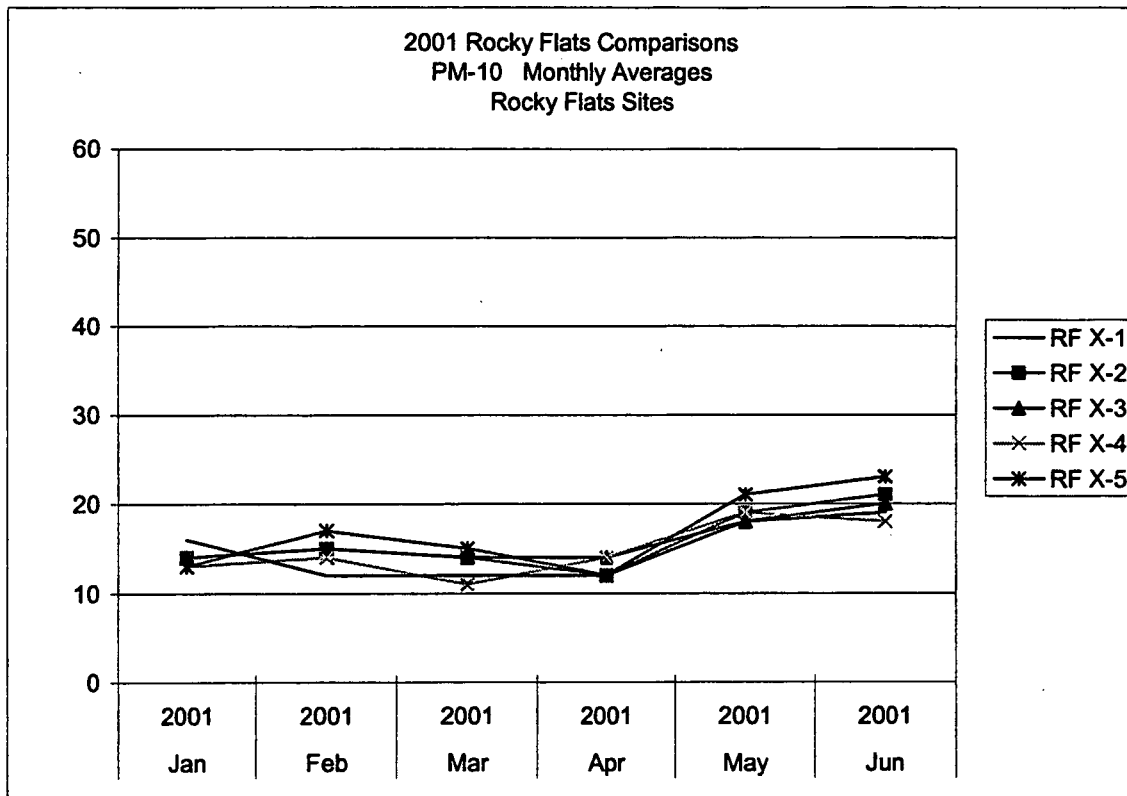
|     |      | RF X-1 | RF X-2 | RF X-3 | RF X-4 | RF X-5 | CAMP | Birch Street,<br>Commerce<br>City | Bldr Cham |
|-----|------|--------|--------|--------|--------|--------|------|-----------------------------------|-----------|
| Jan | 2001 | 16     | 14     | 14     | 13     | 13     | 31   | 36                                | 20        |
| Feb | 2001 | 12     | 15     | 15     | 14     | 17     | 48   | 32                                | 26        |
| Mar | 2001 | 12     | 14     | 14     | 11     | 15     | 44   | 31                                | 26        |
| Apr | 2001 | 12     | 12     | 14     | 14     | 12     | 42   | 34                                | 24        |
| May | 2001 | 18     | 19     | 18     | 19     | 21     | 40   | 32                                | 27        |
| Jun | 2001 | 19     | 21     | 20     | 18     | 23     | 41   | 37                                | 33        |
| Jul | 2001 | X      | X      | X      | X      | X      | 35   | 35                                | 25        |
| Aug | 2001 | X      | X      | X      | X      | X      | 33   | 34                                | 20        |
| Sep | 2001 | X      | X      | X      | X      | X      | 31   | 39                                | 28        |
| Oct | 2001 | X      | X      | X      | X      | X      | 42   | 43                                | 24        |
| Nov | 2001 | X      | X      | X      | X      | X      | 38   | 41                                | 21        |
| Dec | 2001 | X      | X      | X      | X      | X      | 39   | 35                                | 19        |

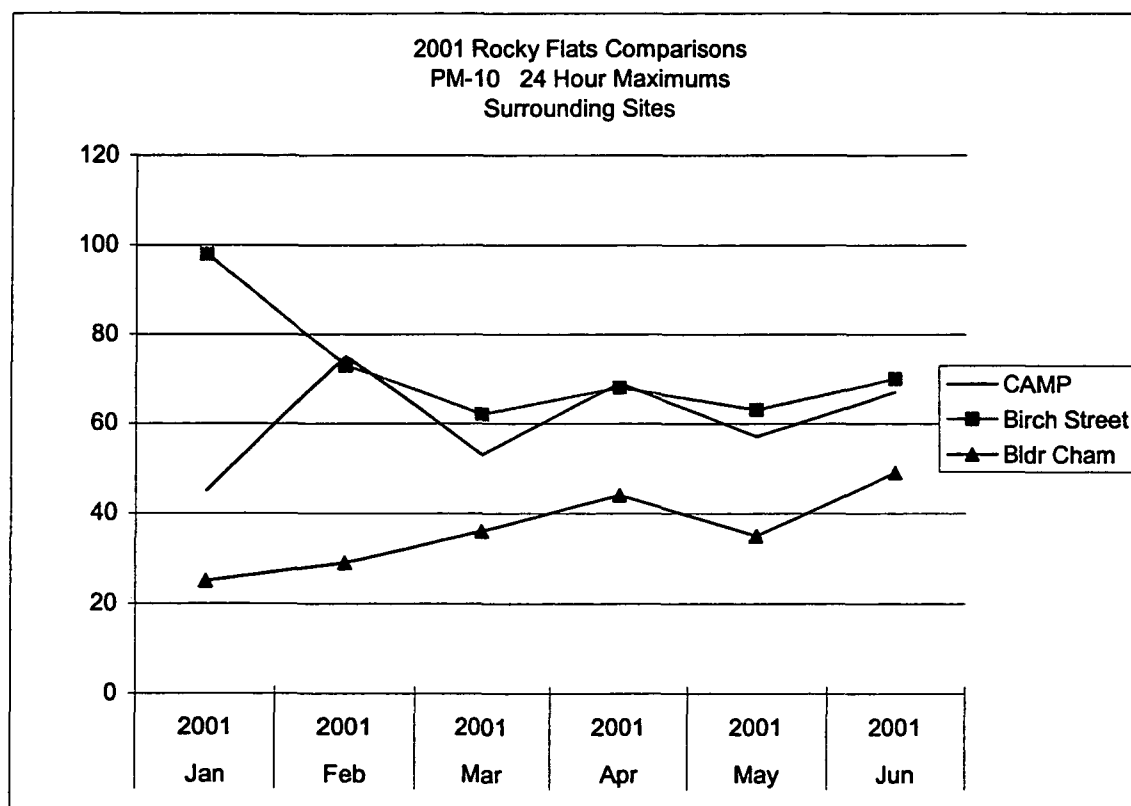
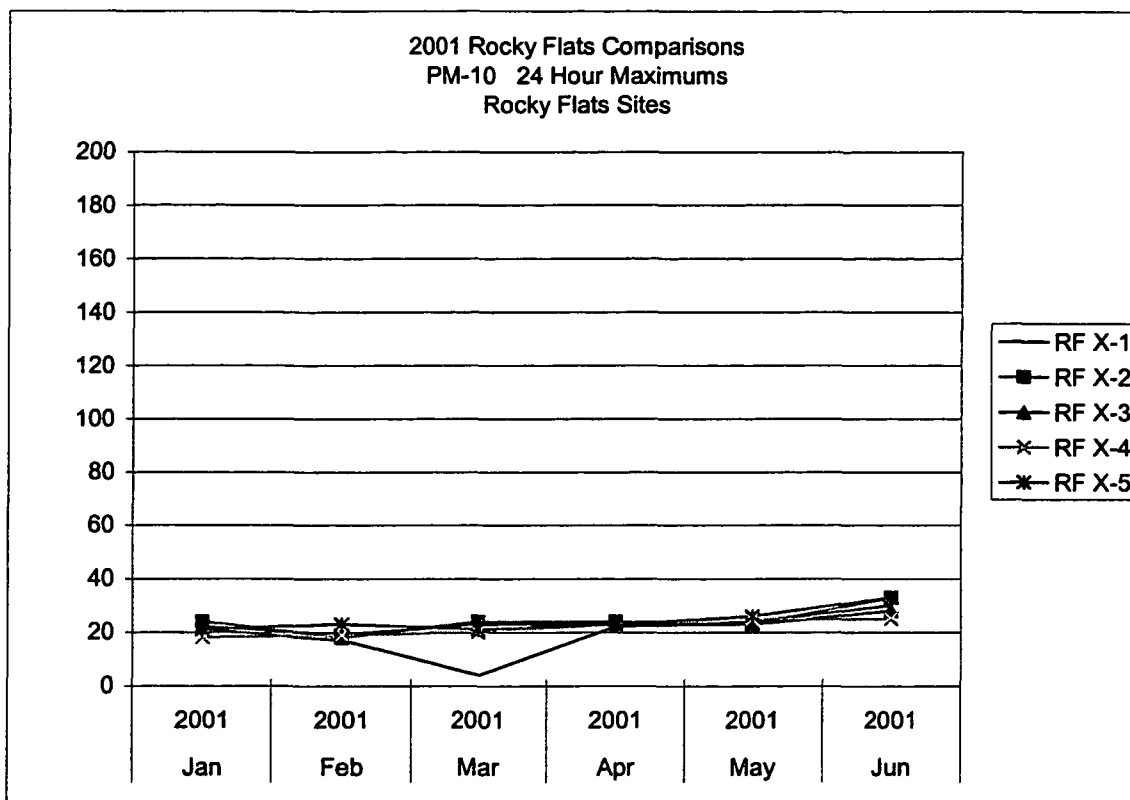
X = Not Available. Sampling terminated at the end of June 2001.

## **Monthly 24-Hour Maximum Data (µg/m<sup>3</sup>)**

|     |      | RF X-1 | RF X-2 | RF X-3 | RF X-4 | RF X-5 | CAMP | Birch Street,<br>Commerce<br>City | Bldr Cham |
|-----|------|--------|--------|--------|--------|--------|------|-----------------------------------|-----------|
| Jan | 2001 | 21     | 24     | 22     | 18     | 21     | 45   | 98                                | 25        |
| Feb | 2001 | 17     | 18     | 19     | 19     | 23     | 75   | 73                                | 29        |
| Mar | 2001 | 4      | 24     | 23     | 20     | 21     | 53   | 62                                | 36        |
| Apr | 2001 | 22     | 24     | 23     | 23     | 23     | 69   | 68                                | 44        |
| May | 2001 | 24     | 23     | 23     | 25     | 26     | 57   | 63                                | 35        |
| Jun | 2001 | 30     | 33     | 28     | 25     | 33     | 67   | 70                                | 49        |
| Jul | 2001 | X      | X      | X      | X      | X      | 78   | 88                                | 27        |
| Aug | 2001 | X      | X      | X      | X      | X      | 48   | 54                                | 26        |
| Sep | 2001 | X      | X      | X      | X      | X      | 38   | 74                                | 48        |
| Oct | 2001 | X      | X      | X      | X      | X      | 54   | 142                               | 40        |
| Nov | 2001 | X      | X      | X      | X      | X      | 59   | 88                                | 29        |
| Dec | 2001 | X      | X      | X      | X      | X      | 66   | 67                                | 26        |

X = Not Available. Sampling terminated at the end of June 2001.





## Nitric Oxide (NO) Comparison 2001

### Monthly Arithmetic Average Data (ppm)

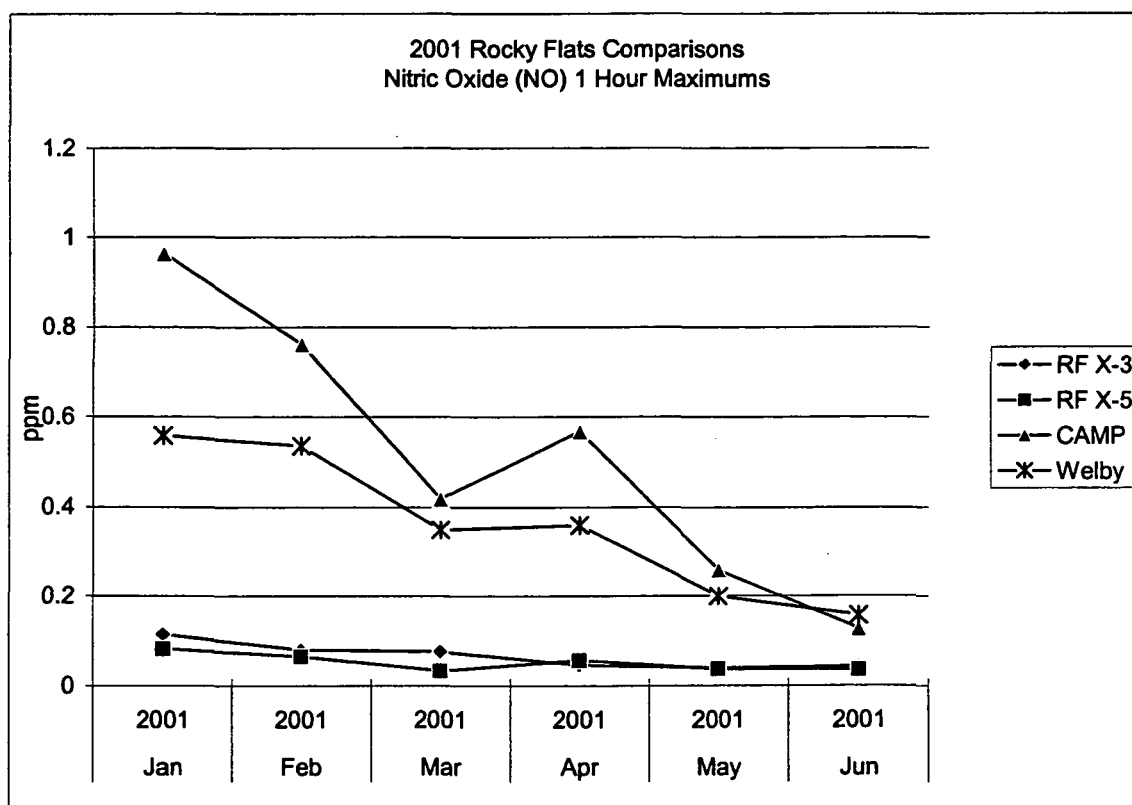
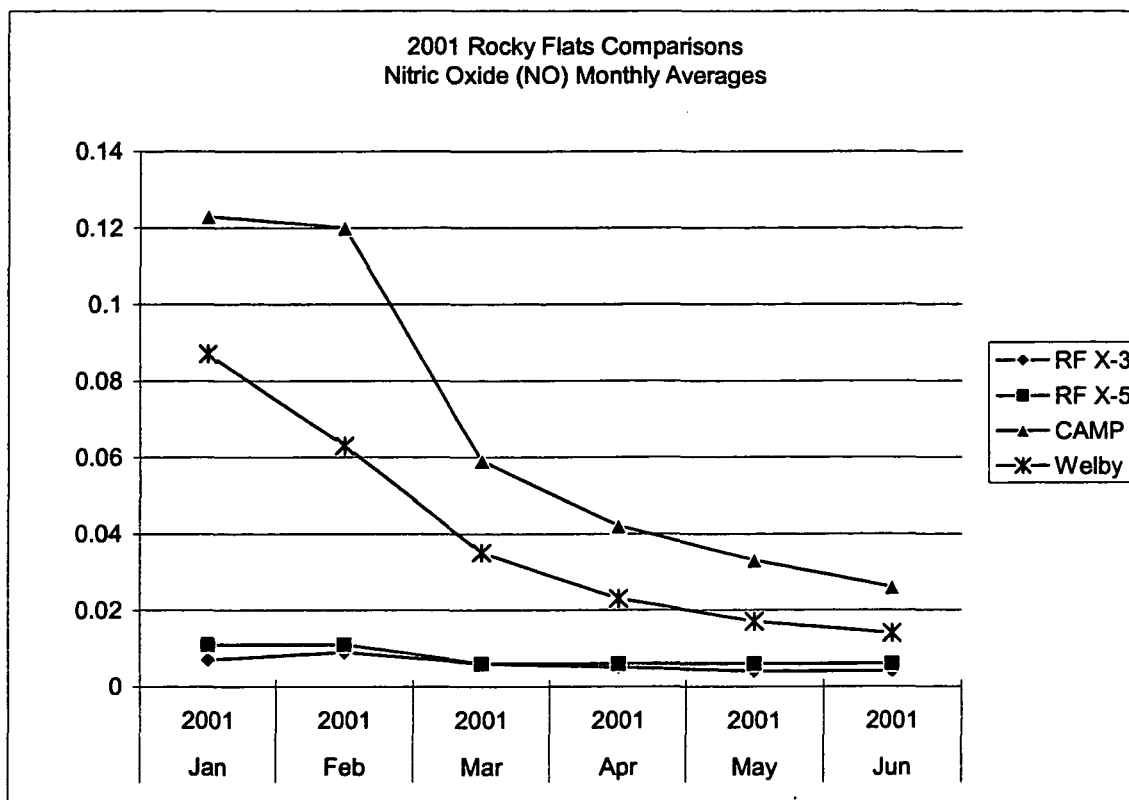
|     |      | RF X-3 | RF X-5 | CAMP | Welby |
|-----|------|--------|--------|------|-------|
| Jan | 2001 | .007   | .011   | .123 | .087  |
| Feb | 2001 | .009   | .011   | .120 | .063  |
| Mar | 2001 | .006   | .006   | .059 | .035  |
| Apr | 2001 | .005   | .006   | .042 | .023  |
| May | 2001 | .004   | .006   | .033 | .017  |
| Jun | 2001 | .004   | .006   | .026 | .014  |
| Jul | 2001 | X      | X      | .024 | .017  |
| Aug | 2001 | X      | X      | .032 | .018  |
| Sep | 2001 | X      | X      | .045 | .031  |
| Oct | 2001 | X      | X      | .084 | .042  |
| Nov | 2001 | X      | X      | .117 | .089  |
| Dec | 2001 | X      | X      | .096 | .079  |

X = Not Available. Sampling terminated at the end of June 2001.

### Monthly 1-Hour Maximum Data (ppm)

|     |      | RF X-3 | RF X-5 | CAMP | Welby |
|-----|------|--------|--------|------|-------|
| Jan | 2001 | 0.115  | 0.082  | .963 | .558  |
| Feb | 2001 | 0.080  | 0.065  | .761 | .535  |
| Mar | 2001 | 0.076  | 0.033  | .418 | .349  |
| Apr | 2001 | 0.046  | 0.056  | .567 | .359  |
| May | 2001 | 0.039  | 0.037  | .259 | .200  |
| Jun | 2001 | 0.043  | 0.036  | .127 | .157  |
| Jul | 2001 | X      | X      | .125 | .211  |
| Aug | 2001 | X      | X      | .225 | .219  |
| Sep | 2001 | X      | X      | .451 | .321  |
| Oct | 2001 | X      | X      | .616 | .515  |
| Nov | 2001 | X      | X      | .816 | .485  |
| Dec | 2001 | X      | X      | .826 | .571  |

X = Not Available. Sampling terminated at the end of June 2001.



## Nitrogen Dioxide (NO<sub>2</sub>) Comparison 2001

### Monthly Arithmetic Average Data (ppm)

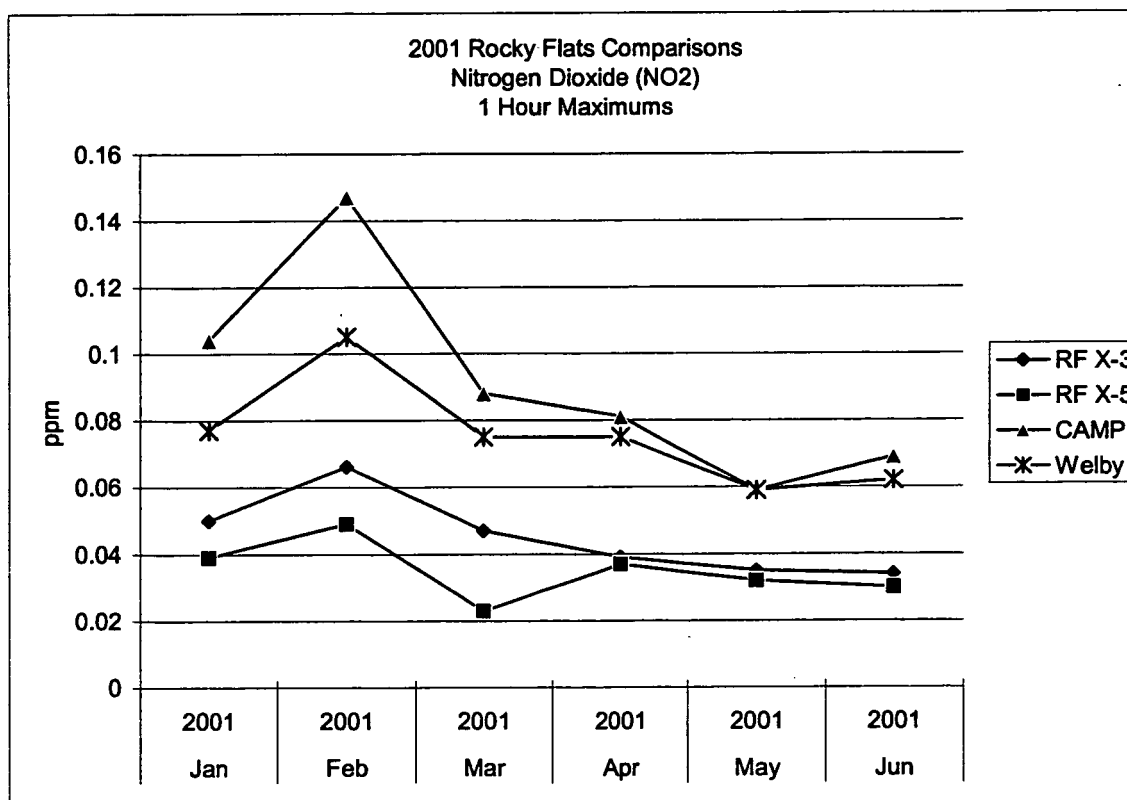
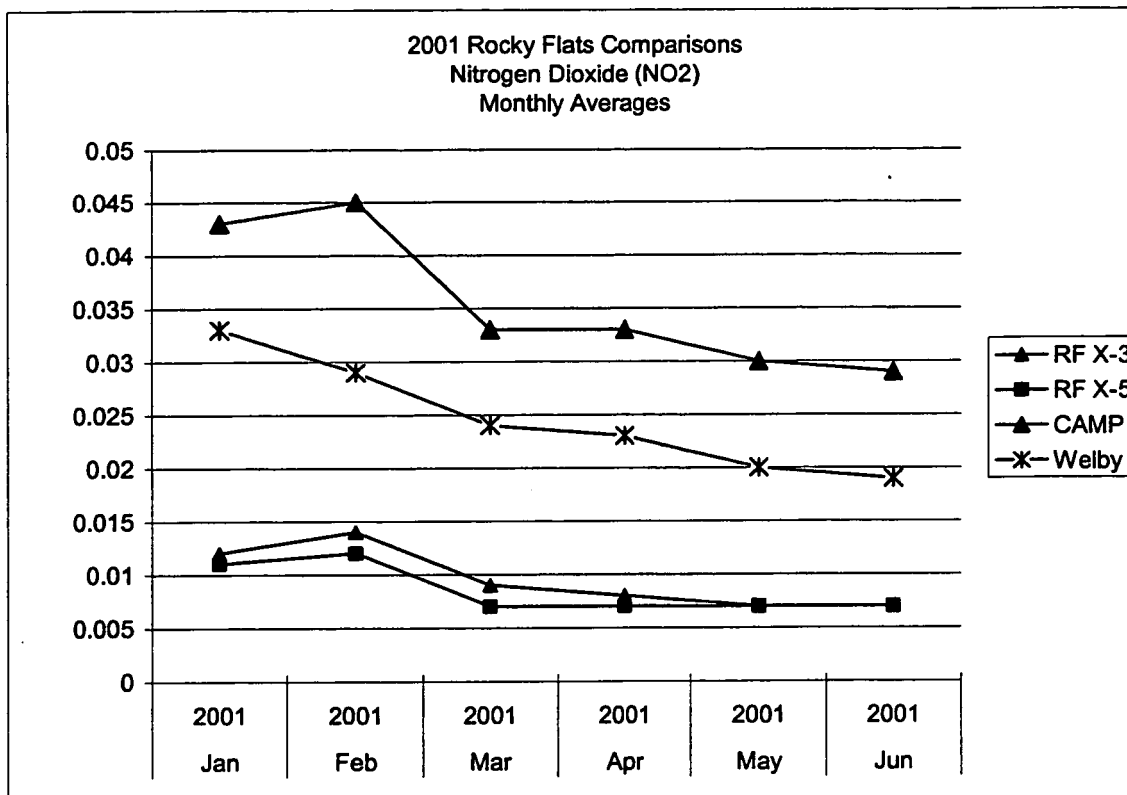
|     |      | RF X-3 | RF X-5 | CAMP | Welby |
|-----|------|--------|--------|------|-------|
| Jan | 2001 | .012   | .011   | .043 | .033  |
| Feb | 2001 | .014   | .012   | .045 | .029  |
| Mar | 2001 | .009   | .007   | .033 | .024  |
| Apr | 2001 | .008   | .007   | .033 | .023  |
| May | 2001 | .007   | .007   | .030 | .020  |
| Jun | 2001 | .007   | .007   | .029 | .019  |
| Jul | 2001 | X      | X      | .030 | .025  |
| Aug | 2001 | X      | X      | .036 | .025  |
| Sep | 2001 | X      | X      | .039 | .025  |
| Oct | 2001 | X      | X      | .041 | .024  |
| Nov | 2001 | X      | X      | .047 | .031  |
| Dec | 2001 | X      | X      | .042 | .032  |

X = Not Available. Sampling terminated at the end of June 2001.

### Monthly 1-Hour Maximum Data (ppm)

|     |      | RF X-3 | RF X-5 | CAMP | Welby |
|-----|------|--------|--------|------|-------|
| Jan | 2001 | .050   | .039   | .104 | .077  |
| Feb | 2001 | .066   | .049   | .147 | .105  |
| Mar | 2001 | .047   | .023   | .088 | .075  |
| Apr | 2001 | .039   | .037   | .081 | .075  |
| May | 2001 | .035   | .032   | .059 | .059  |
| Jun | 2001 | .034   | .030   | .069 | .062  |
| Jul | 2001 | X      | X      | .072 | .081  |
| Aug | 2001 | X      | X      | .074 | .073  |
| Sep | 2001 | X      | X      | .078 | .077  |
| Oct | 2001 | X      | X      | .091 | .077  |
| Nov | 2001 | X      | X      | .157 | .086  |
| Dec | 2001 | X      | x      | .113 | .090  |

X = Not Available. Sampling terminated at the end of June 2001.



# Ozone (O<sub>3</sub>) Comparison 2001

## Monthly 8-Hour Maximum Data (ppm)

|          | RF X-1 | Welch | Arvada | NREL | S. Boulder Creek | Welby |
|----------|--------|-------|--------|------|------------------|-------|
| Jan 2001 | .050   | .043  | .041   | .048 | .045             | .029  |
| Feb 2001 | .049   | .036  | .040   | .040 | .046             | .029  |
| Mar 2001 | .053   | .043  | .044   | .052 | .047             | .038  |
| Apr 2001 | .073   | .057  | .060   | .075 | .064             | .061  |
| May 2001 | .067   | .065  | .064   | .070 | .058             | .058  |
| Jun 2001 | .083   | .061  | .071   | .077 | .073             | .059  |
| Jul 2001 | .087   | .064  | .078   | .083 | .071             | .066  |
| Aug 2001 | .082   | .080  | .083   | .090 | .076             | .064  |
| Sep 2001 | .057   | .060  | .064   | .070 | .058             | .049  |
| Oct 2001 | .050   | .047  | .043   | .054 | .048             | .036  |
| Nov 2001 | .041   | .037  | .036   | .042 | .036             | .027  |
| Dec 2001 | .046   | .040  | .043   | .044 | .042             | .030  |

X = Not Available. Sampling terminated at the end of June 2001.

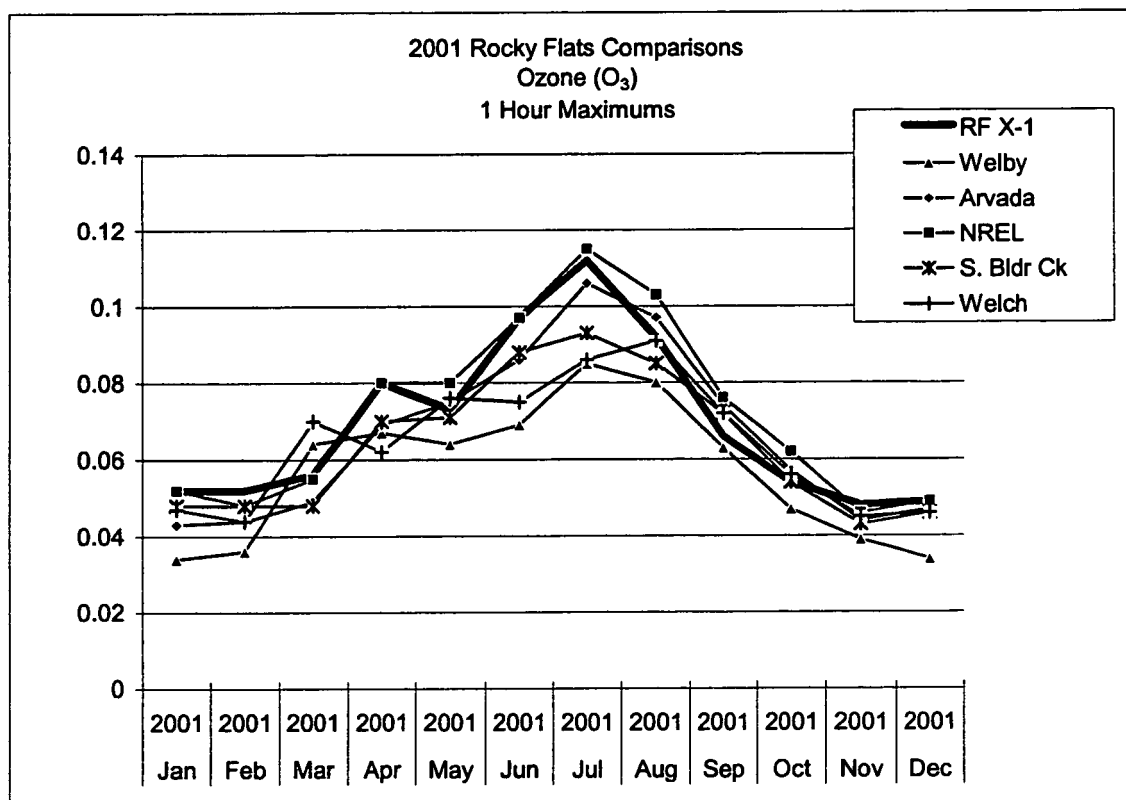
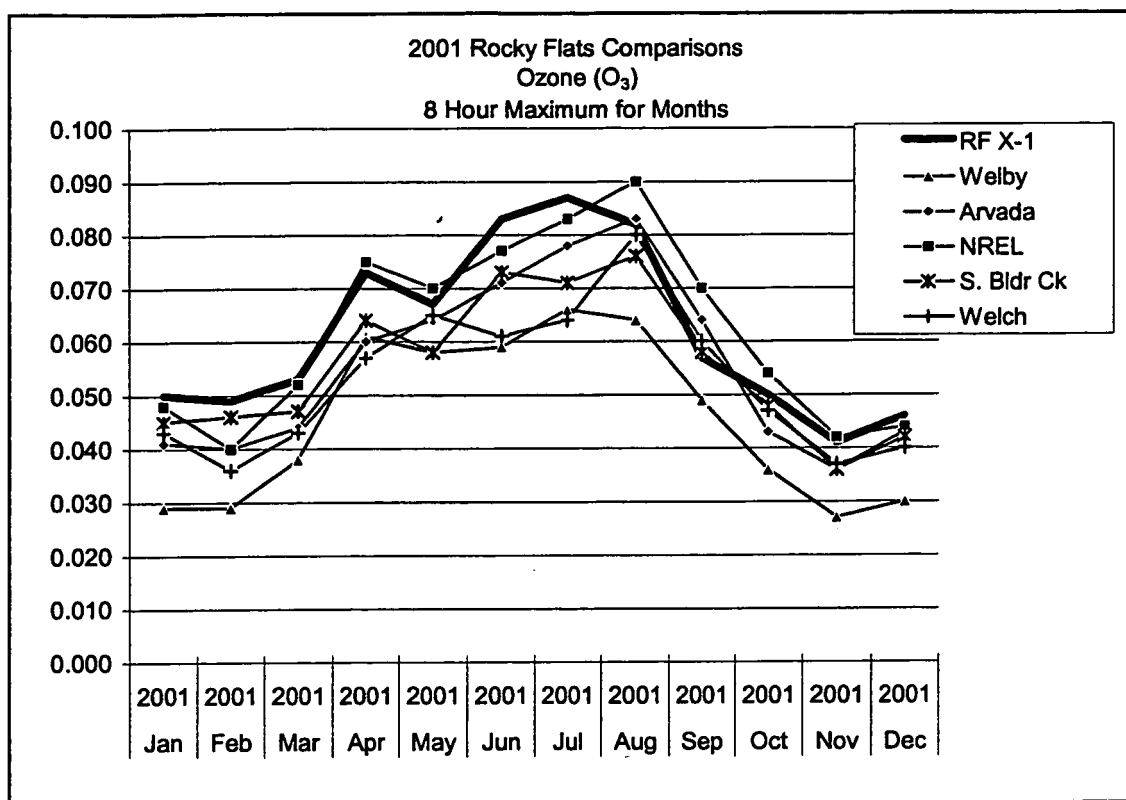
## Monthly 1-Hour Maximum Data (ppm)

|          | RF X-1 | Welch | Arvada | NREL | S. Boulder Creek | Welby |
|----------|--------|-------|--------|------|------------------|-------|
| Jan 2001 | .052   | .047  | .043   | .052 | .048             | .034  |
| Feb 2001 | .052   | .044  | .044   | .048 | .048             | .036  |
| Mar 2001 | .056   | .070  | .049   | .055 | .048             | .064  |
| Apr 2001 | .080   | .062  | .069   | .080 | .070             | .067  |
| May 2001 | .073   | .076  | .075   | .080 | .071             | .064  |
| Jun 2001 | .097   | .075  | .086   | .097 | .088             | .069  |
| Jul 2001 | .112   | .086  | .106   | .115 | .093             | .085  |
| Aug 2001 | .092   | .091  | .097   | .103 | .085             | .080  |
| Sep 2001 | .066   | .072  | .074   | .076 | .072             | .063  |
| Oct 2001 | .054   | .056  | .057   | .062 | .054             | .047  |
| Nov 2001 | .048   | .045  | .044   | .046 | .043             | .039  |
| Dec 2001 | .049   | .046  | .047   | .049 | .046             | .034  |

X = Not Available. Sampling terminated at the end of June 2001.

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**Colorado Department  
of Public Health  
and Environment**